Trouble-shooting instructions : SAA-5000

BOSCH system : K - Jetronic

Vehicle make : SAAB

Basic microcard : PKW - 033

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SPECIAL FEATURES

These instructions contain the K-Jetronic trouble-shooting instructions for the following SAAB models valid at the time of writing:

SAAB 900 Injection CAT 05.85->
2.0 ltr. / 4-cyl. engine

* Lambda closed-loop control and catalytic converter

* Fuel enrichment using pressure-surge switch and start valve at temperatures below 25°C

* Fuel enrichment using pressure-surge switch and timing valve of the lambda closed-loop control at temperatures below 25°C (up to a max. of 2 minutes after each start)

* Overrun cut-off (on vehicles with manual transmission)

* In-tank electric fuel pump

* In-tank pre-supply pump

Important: When referring to a basic microcard, note that the test specifications must always be taken from the vehicle-specific brief instructions.

SAFETY AND PRECAUTIONARY MEASURES

Always observe safety and precautionary measures in order to avoid hazards to persons and damage to the engine, the trigger box and control unit, and the ignition system.

CAUTION!
High-performance ignition system with dangerous high and low voltages!

Contact with voltage-carrying parts or terminals can be fatal (on both primary and secondary sides).

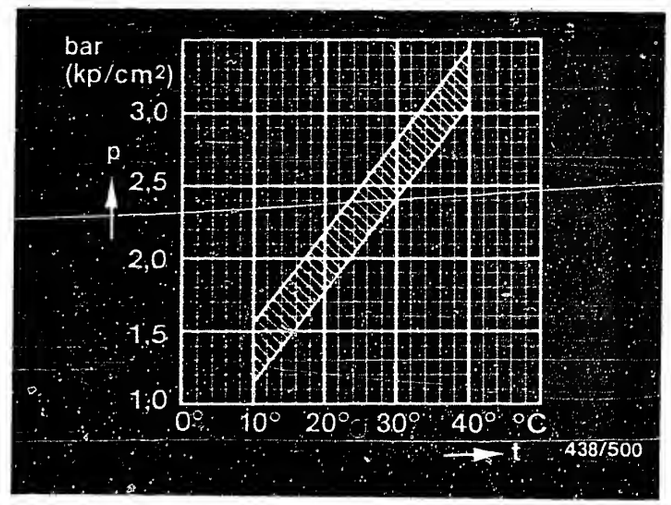
TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)

1. Starting motor operates, engine fails to start or starts only with difficulty.	2. Engine starts but then dies.	3. Idle problems (engine speed, exhaust).	4. Poor throttle response.	5. Engine missing (ignition, fuel injection).	6. Insufficient engine power/ top speed.	7. Excessive fuel consumption.	8. Engine diesels.	9. Engine pings / knocks.	10. Engine gets too hot.	11. Fault lamp.	Cause (component fault)
*	*			*							Electric fuel pump
*		*	*		*						Induction system
*											Fuel system
*		*	*	*	*		*				Fuel distributor
*		*	*	*	*		*				Air-flow sensor
*		*				*	*				Cold-starting system
*		*		*			*				Fuel-injection valves
	*			*	*						System pressure
*	*	*	*	*	*	*					Control pressure
*		*	*		*						Overall delivered-quantity scatter
					*						Throttle valve
*		*	*		*	*	*				Lambda closed-loop control
*		*									Auxiliary-air device

TEST SPECIFICATIONS

No.	Testing/Test condition	Set specification
1	Electric fuel pump – fuel delivery: Supply voltage (under load):	at least 1500 cm ^{3} /min at least 11,5 V
2	Fuel delivery – control-pressure circuit:	160...240 cm ^{3} /min
3	Fuel distributor – system pressure: Test specification: Setting:	 4,7...5,4 bar 4,9...5,1 bar
4	Control pressure: Take control pressure "cold" from the chart opposite corresponding to the ambient temperature measured. Control pressure "warm":	 3,4...3,8 bar
5	Leakage test – total system: Minimum pressure after 10 mins.: Minimum pressure after 20 mins.:	 2,5 bar 2,4 bar
6	Injection valves – opening pressure: Leakage test at not below 2,8 bar: No drop must fall within 25s.	3,0...4,1 bar



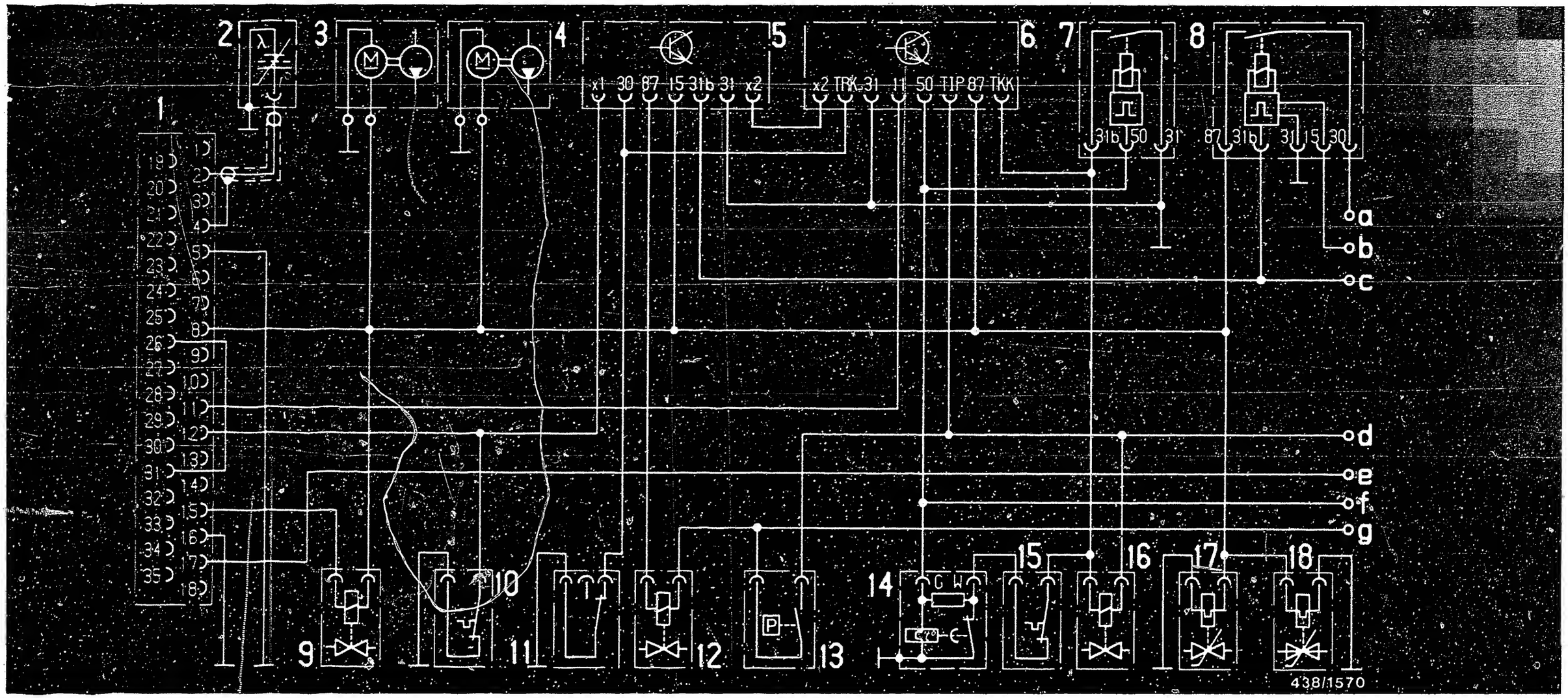
p = Contr. press. (overpress.)
t = Ambient temperature

TEST SPECIFICATIONS (CONTINUED)

No.	Test/test conditions	Test specification	
7	Comparative measurement of supply quantity:	Setting point: (cm^3/min)	max. perm. quantity: (cm^3/min)
	Idle :	6,0	6,8
	Part load:	40,0	42,5
	Full load:	150,0	162,0
	Minimum quantity at max. sensor plate deflection:	162 cm^3/min	
8	Thermo-time switch – resistance measurement:	below + 40° C	above + 50° C
	Terminal G and ground:	30...40 Ω	55....85 Ω
	Terminal W and ground:	0 Ω	120...160 Ω
	Terminal G and terminal W:	30...40 Ω	55....85 Ω
9	Idle setting*		
	Idle speed:	800...900 min^{-1}	
10	Lambda closed-loop control**		
	Test conditions:		
	Closed-loop control oscillating, mean value:	45...55 %	
	t_0 (lean stop):	max. 20 %	
	t_1 (open-loop control):	45...55 %	
	t_2 (rich stop):	min. 85 %	
	t_3 (warm-up enrichment):	55...65 %	
	t_4 (Acceleration enrichment, temperature > 25°C, up to max. 2 min. after each start):	80...100 %	
	Timing valve, internal resistance at + 20°C:	2...3 Ω	

* Idle speed is adjusted with bypass screw on throttle-valve assembly

** Lambda closed-loop control is adjusted using the idle-mixture-adjusting screw.

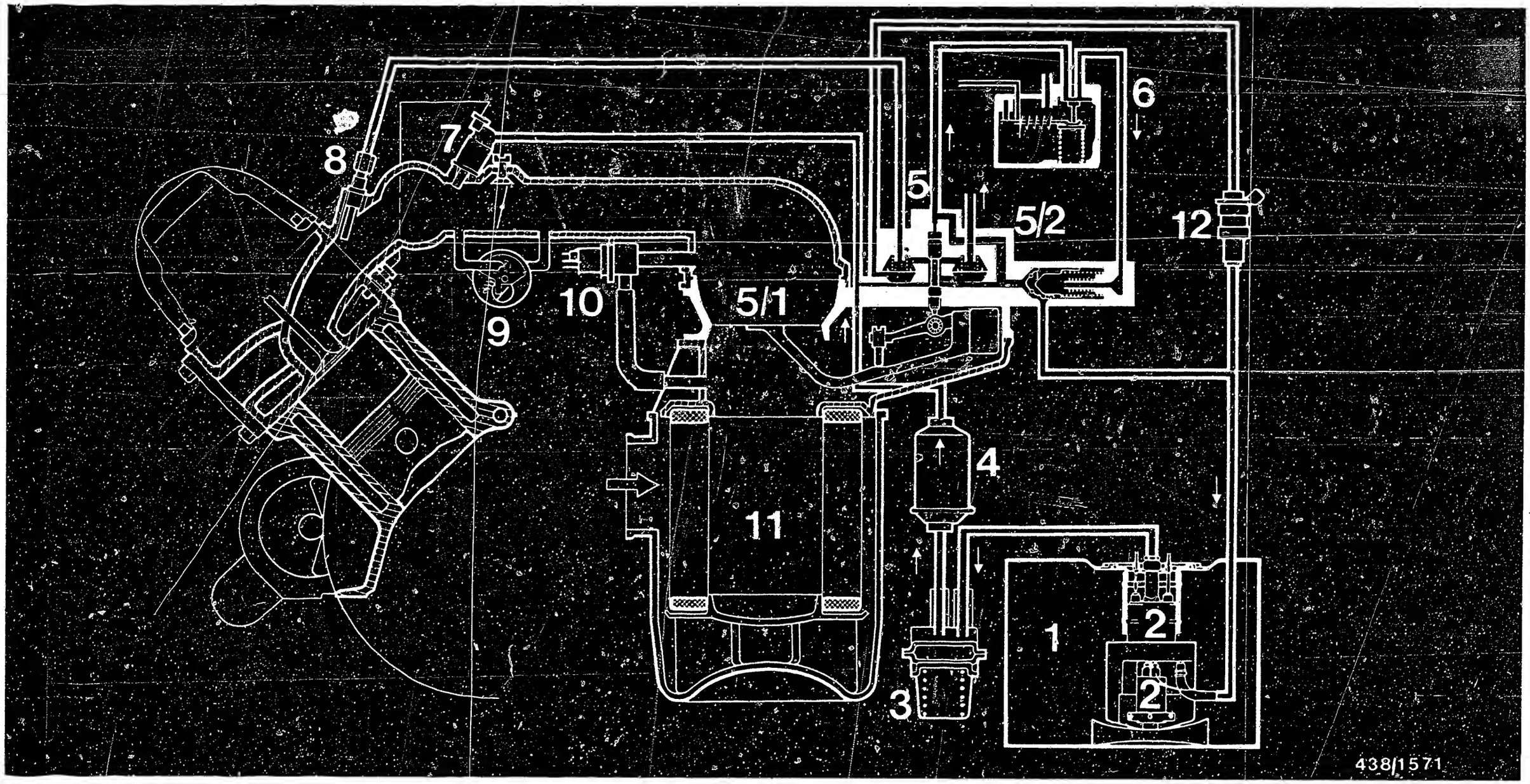


1 = Contr. unit, lambda c-l contr.
2 = Lambda sensor
3 = Electric fuel pump
4 = Pre-supply pump
5 = Engine-speed relay
6 = Time-lag relay
7 = Warm-start relay
8 = Fuel-pump relay
9 = Timing valve
10 = Temperature switch, +45°C
11 = Throttle-valve switch
12 = Overrun cut-off sol.-op. valve
13 = Pressure-surge switch
14 = Thermo-time switch
15 = Temperature switch, +25°C
16 = Start valve
17 = Warm-up regulator
18 = Auxiliary-air device

a = Terminal 30
b = Terminal 15
c = TD signal
d = Terminal 16
e = Lambda meas. output
f = Terminal 50
g = Terminal 54

ELECTRICAL TERMINAL DIAGRAM WITH SAFETY CIRCUITRY FOR ELECTRIC FUEL PUMP

A09 —⟹
A10 —⟸



1 = Fuel tank
2 = Electric fuel pump/pre-supply pump
3 = Fuel accumulator
4 = Fuel filter
5 = Mixture-control unit
5/1 = Air-flow sensor
5/2 = Fuel distributor
6 = Warm-up regulator
7 = Start valve
8 = Fuel-injection valve
9 = Auxiliary-air device
10 = Solenoid-op. valve for overrun cut-off
11 = Air filter
12 = Timing valve

AIR/FUEL LINE DIAGRAM

A11 ⟹

A12 ⟸

INSTALLATION POSITION OF COMPONENTS

* Control unit for lambda closed-loop control:
  On right beneath rear seat.

* Timing valve:
  In engine compartment where drive shaft passes through body.

* Lambda sensor:
  In engine compartment in exhaust manifold.

* Lambda measurement output:
  In engine compartment, 2-pin plug connection on left wheel well.

* Fuel-pump relay:
  In engine compartment in central electrics box on left wheel well.

* Time-lag relay, warm-start relay:
  In engine compartment at central lambda relay position on left wheel well.

* +25°C temperature switch:
  In engine compartment in intake manifold.

* +45°C temperature switch, thermo-time switch, warm-up regulator, auxiliary-air device: In engine compartment, in thermostat housing at front of engine.

* Start valve:
  In engine compartment on throttle-valve assembly.

* Pressure-surge switch:
  In engine compartment on left wheel well beside fuel filter.

* Solenoid-op. valve for overrun cut-off:
  In engine compartment above air filter in rubber elbow.

* Electric fuel pump, pre-supply pump:
  In fuel tank beneath trunk floor.

For production reasons:
continued on the following coordinate.

T A B L E O F C O N T E N T S

Trouble-shooting instructions: SEA-5001

BOSCH system : EI

Vehicle make : Seat

Basic microcard : OPE-513

Section	Coordinates
Special features, construction, use, safety and preventative measures	02
Trouble-shooting chart (customer complaint)	04
Rapid diagnosis chart	05
Test specifications	11
Electrical terminal diagram	13
Installation position of components with instructions for removal and installation	15

SPECIAL FEATURES

These trouble-shooting instructions apply to the following Seat models valid at the time of writing:

* Ibiza 1.5 Injection, as of November 1986

* Electronic ignition system with load-signal detection (EI).

* Spark-advance unit 0 227 921 022 or. ..051

* Trigger box 0 227 100 124 with current limiting

USAGE, STRUCTURE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to various causes/ component faults.

Detailed instructions for trouble-shooting must be taken from the basic instructions via the trouble-shooting chart.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of t h e s e vehicle-related brief instructions are a l w a y s binding.

SAFETY AND PRECAUTIONARY MEASURES

Keep persons out of danger.
Prevent damage to the engine, trigger box or ignition system.

* C A U T I O N !
  High-performance ignition system.
  Dangerous primary and secondary voltages.

  Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

* When testing the compression, disconnect the trigger-box plug or connect ignition coil term. 4 f i r m l y to ground using auxiliary cable.

N O T E :
Auxiliary cable must be interference-suppressed with at least 2 k Ω .

See basic instructions for further precautionary measures.

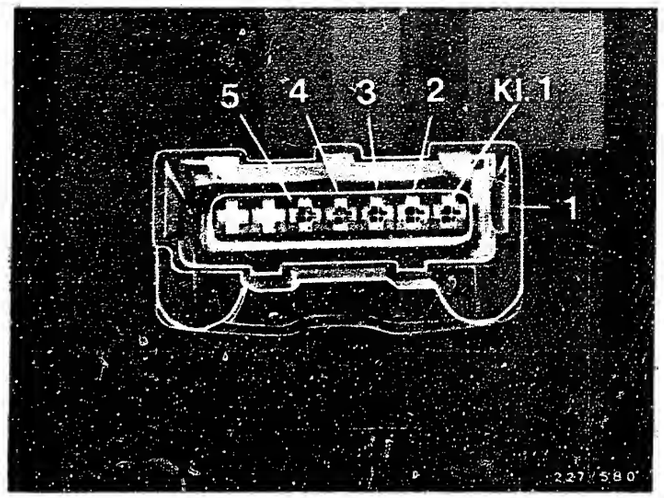
TROUBLE-SHOOTING CHART

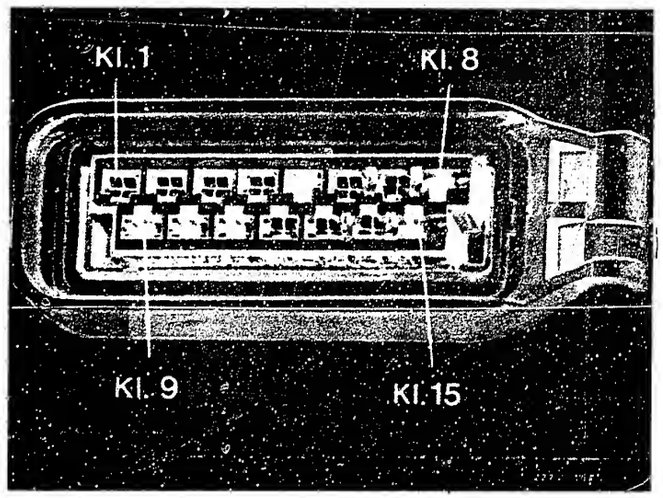
Customer complaint (symptoms of trouble)

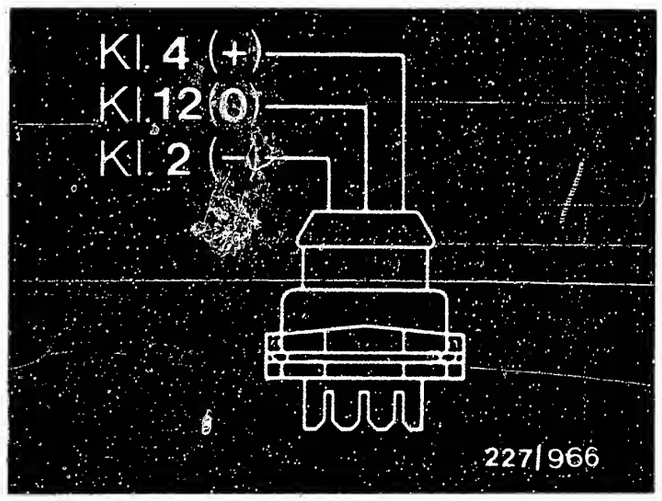
1. Starting motor operates, engine fails to start or starts only with difficulty.	2. Engine starts but then dies.	3. Idle problems (engine speed, exhaust).	4. Poor throttle response.	5. Engine missing (ignition, fuel injection).	6. Insufficient engine power/ top speed.	7. Excessive fuel consumption.	8. Engine diesels.	9. Engine pings/knocks.	10. Engine gets too hot.	11. Fault lamp.	Cause (component defect)
*		*	*	*	*	*					High-voltage side
*		*	*	*	*						Ignition coil
*		*									Firing sequence
*											Voltage, trigger box
*											Voltage, primary circuit
*											Voltage, spark-advance unit
*			*	*							Voltage, magnetic pulse generator
*			*	*							Function, magnetic pulse generator
*											Function, spark-advance unit
*											Engine-speed signal
*											Ignition distributor
*											Contact resistances
		*	*	*	*	*		*	*		Throttle-valve switch LL
		*	*	*	*	*		*	*		Throttle-valve switch VL
		*	*	*	*	*		*	*		Basic ignition setting
					*	*					Jetronic load signal
				*							Voltage, spark-advance unit
				*							Voltage, trigger box
				*							Voltage, ignition coil
				*							Primary voltage

RAPID DIAGNOSIS CHART

Test step	Test of components/function Test conditions/instructions	Terminals		Nominal values
1	HIGH-VOLTAGE SIDE visual check (distributor cap, ignition harness etc.) Ignition oscillogram	———		———
2	IGNITION COIL visual check, sealing plugs present, sealing compound escaped? Primary resistance Secondary resistance	 1 1	 15 4	 0.6...1.0 Ω 6.4...11.1 K Ω
3	VOLTAGE SUPPLY, CONTROL UNIT Ignition ON. Voltage, trigger box plug	4 +	2 –	approx. V_B
4	PRIMARY CIRCUIT Ignition ON. Voltage, trigger box plug	1 +	2 –	approx. V_B
5	VOLTAGE SUPPLY, SPARK-ADVANCE UNIT Ignition ON. Voltage, spark-advance unit plug	3 +	1 –	approx. V_B
6	VOLTAGE SUPPLY, MAGNETIC PULSE GENERATOR Ignition ON. Voltage, ignition distributor plug	4 +	2 –	> 10 V
7	FUNCTION, MAGNETIC PULSE GENERATOR Start engine. Test signal, ignition distributor plug and vehicle ground.	12 +	B– –	Rectangular pulse



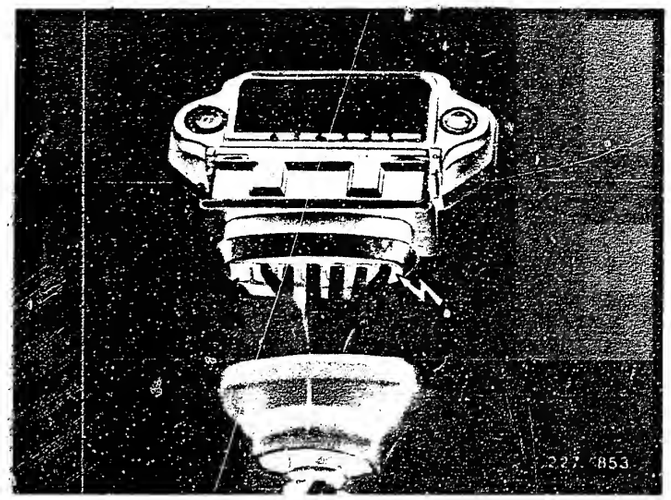


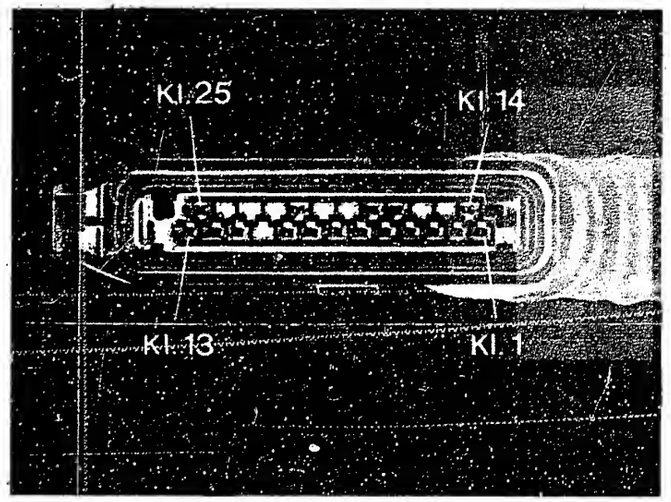


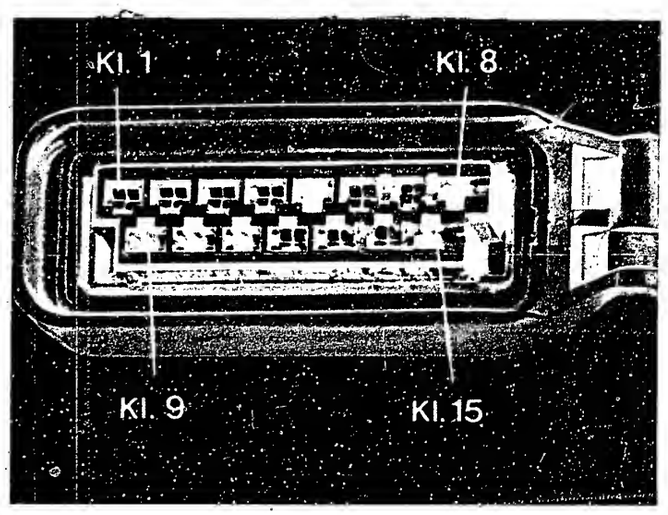
RAPID DIAGNOSIS CHART (continued)

Test step	Test of components/function Test conditions/instructions	Term.	Nominal values
8	SPARK-ADVANCE UNIT Plugs for trigger box, ignition distributor, and spark-advance unit are plugged in. Start engine. Test signal at trigger box plug and vehicle ground.	5 B- + –	Rectangular pulse
9	ENGINE-SPEED SIGNAL Start engine. Test signal, Jetronic control-unit plug and vehicle ground.	1 B- + –	Rectangular pulse
10*	IGNITION DISTRIBUTOR ASSEMBLY ADJUSTMENT Engine cyl. 1 TDC. Distributor rotor points to housing marking.	———	———
	CONTACT RESISTANCES Test voltage supply leads of trigger box and primary circuit for contact resistances.		max. 0.3 Ω
11	THROTTLE-VALVE SWITCH, IDLE Start engine. Voltage, spark-advance unit plug.	6 1 + –	approx. V_B
12	THROTTLE-VALVE SWITCH, FULL LOAD Throttle valve open all the way, start engine. Voltage, spark-advance unit plug	14 1 + –	approx. V_B

* Carry out only with engine not running.

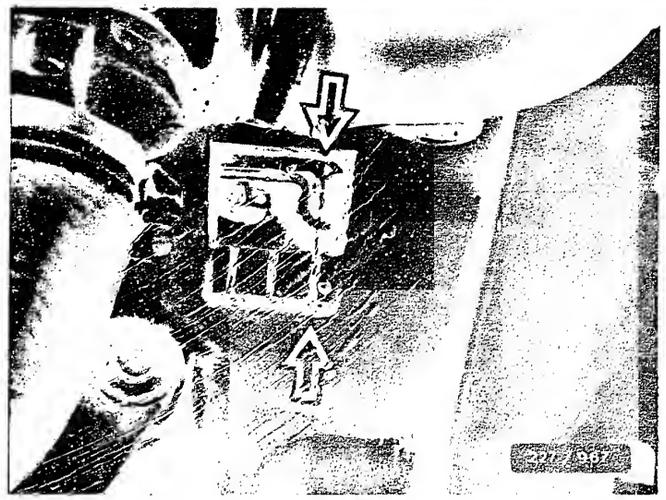


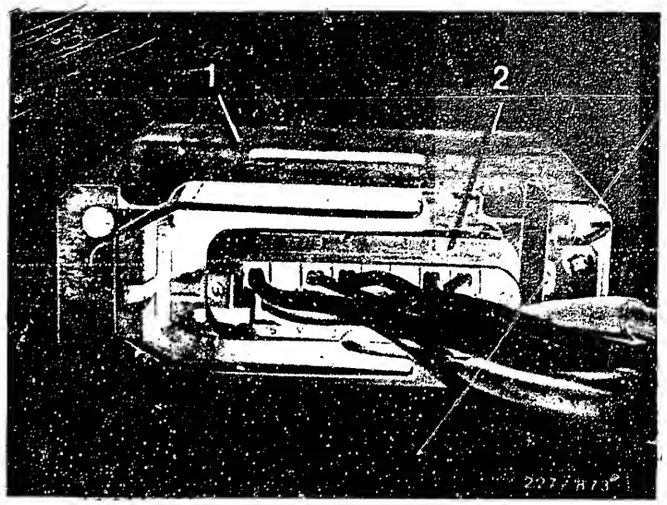


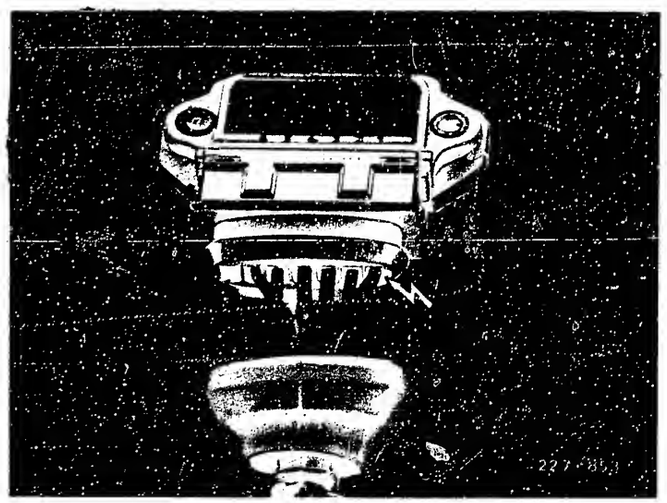


RAPID DIAGNOSIS CHART (continued)

Test step	Test of components/function Test conditions/instructions	Term.		Nominal values
13	BASIC IGNITION SETTING Plug short-circuit device KDZS 0003 onto throttle-valve switch plug. Run engine in idle, read off ignition point. Increase engine speed. The ignition point must not change.	———		10° before TDC at 800...900 min $^{-1}$
14	JETRONIC LOAD SIGNAL Dwell angle, spark-advance unit plug and battery positive terminal with engine idling. Accelerate briefly.	15 –	B+ +	Change in dwell angle
15	VOLTAGE SUPPLY, SPARK-ADVANCE UNIT Voltage, spark-advance unit plug with handle cover removed and engine in idle	3 +	1 –	12...14 V, max. 1 V below V_B
15	VOLTAGE SUPPLY, TRIGGER BOX Voltage, trigger-box plug with engine in idle	4 +	2 –	12...14 V, max. 1 V below V_B
16	VOLTAGE SUPPLY, IGNITION COIL Engine in idle. Voltage, ignition coil and battery terminal negative	15 +	B– –	> 10 V
17	PRIMARY VOLTAGE Voltage, ignition coil with engine idling.	15 +	1 –	295...365 V





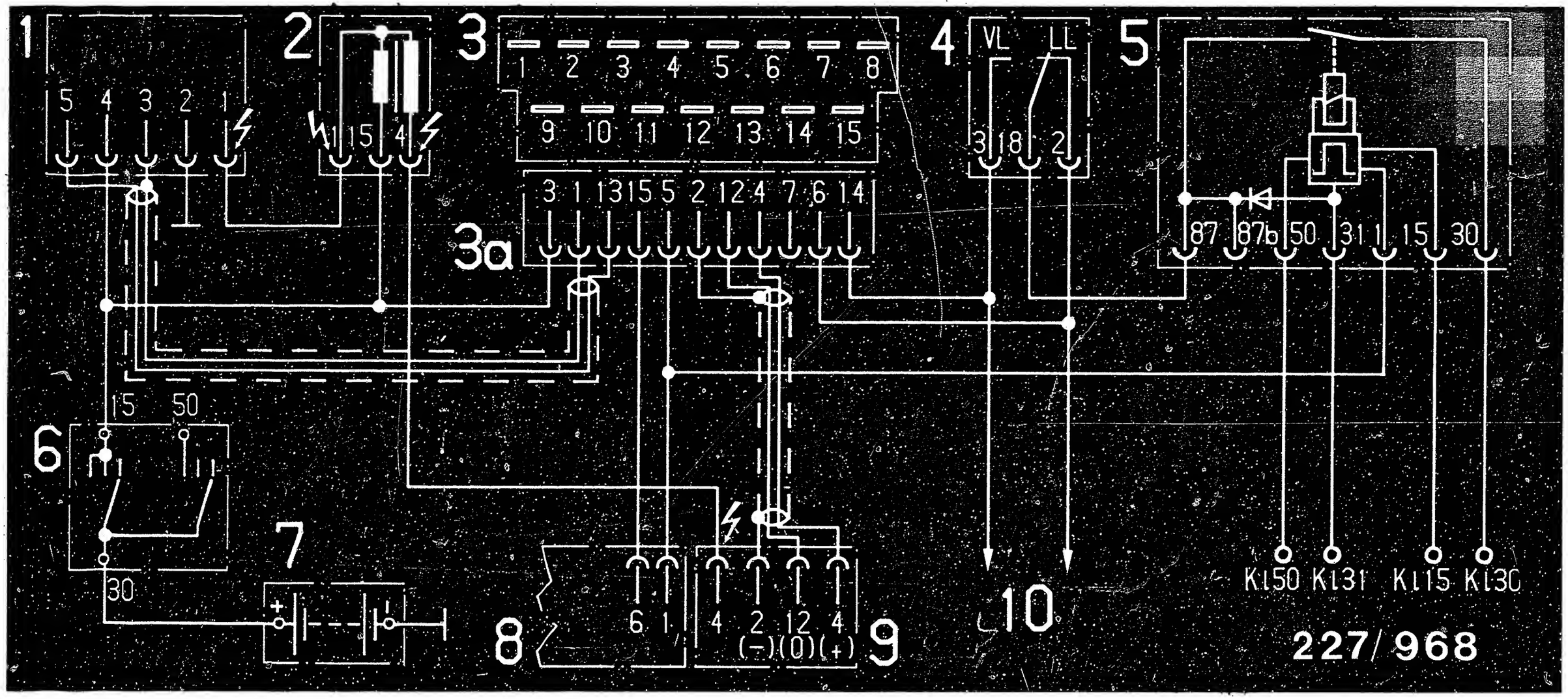


TEST SPECIFICATIONS

Ignition coil, primary	0,6...10 Ω
secondary	6,4...11,1 k Ω
Basic ignition setting at engine speed of	10 ° before TDC 800...900 min $^{-1}$
Voltage supply, spark-advance unit with engine idling	12...14 V
Voltage supply, trigger box with engine idling	12...14 V
Voltage supply, ignition coil with engine idling	> 10 V
Primary voltage with engine idling	295...365 V
Voltage supply, magnetic pulse generator with ignition on	> 10 V

For adjustment values for idle speed, exhaust, valve play etc., see Autodata test specifications.

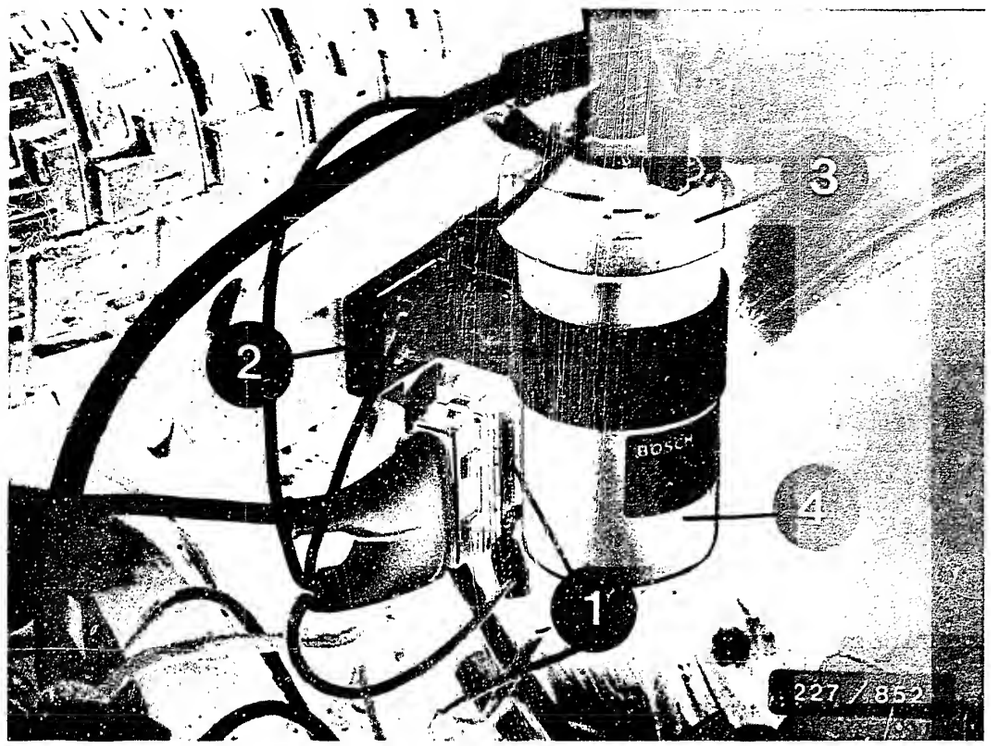
For production reasons: continued on the following coordinate.



High-voltage arrows = hazardous voltages (400 V – 25 kV)

1 = Trigger box
2 = Ignition coil
3 = Spark-advance unit plug
3a = Spark-advance unit
4 = Throttle-valve switch
5 = Jetronic control relay
6 = Ignition and starting switch
7 = Battery
8 = Jetronic control unit
9 = Ignition distributor
10 = To Jetronic control unit

ELECTRICAL TERMINAL DIAGRAM



1 = TI trigger box

2 = Cooling plate

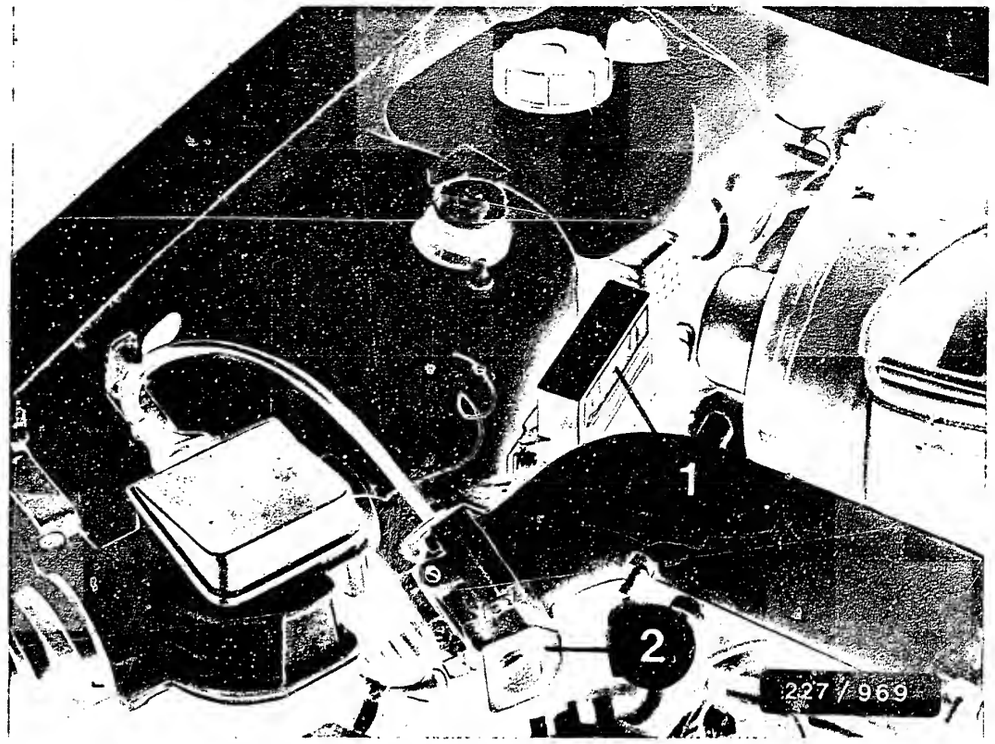
3 = Protective cap

4 = Ignition coil

INSTALLATION POSITION OF COMPONENTS

The trigger box and ignition coil are mounted on the same cooling plate, see illustration.

The Jetronic control unit is located behind the ignition coil (not visible in illustration).

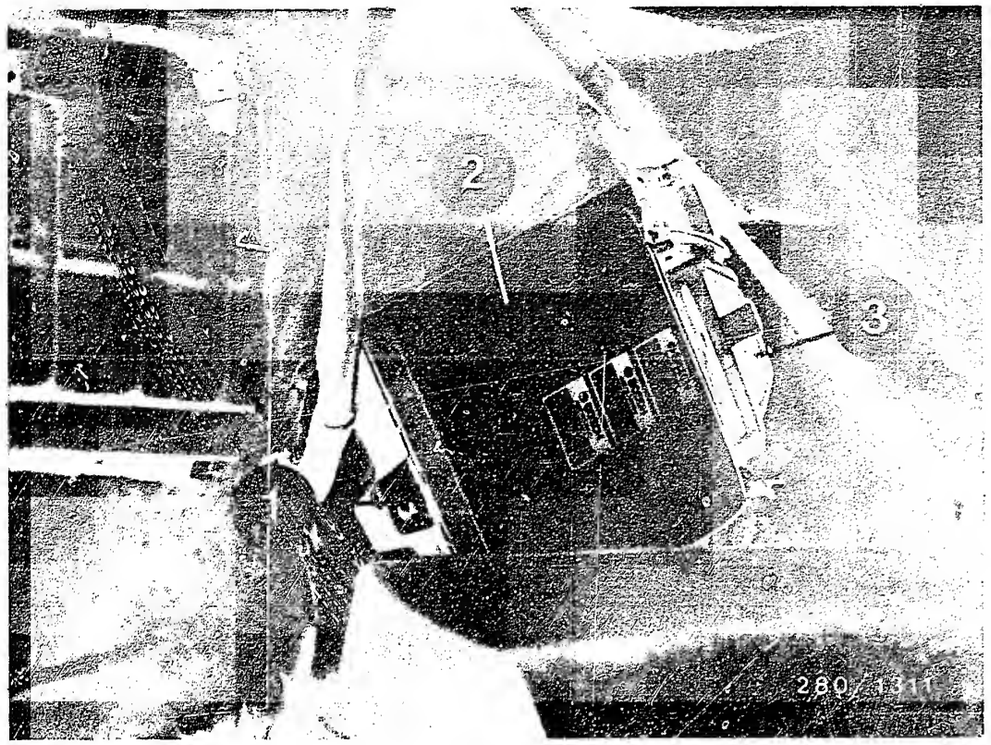


1 = Spark-advance unit

2 = Throttle-valve switch

INSTALLATION POSITION OF COMPONENTS (continued)

To remove the spark-advance unit, remove the air filter.



1 = Fastening screw
2 = Jetronic control unit
3 = Control-unit plug

INSTALLATION POSITION OF COMPONENTS
(continued)

The Jetronic control unit is located in the passenger compartment on the passenger side on the facewall of the footwell.
To remove it, loosen the panel on the right and push it to the left.

For production reasons:
continued on the following coordinate.

Trouble-shooting instructions	:	PEU - 5002
Bosch system	:	VE - EDC
Vehicle make	:	PEUGEOT
Basic microcard	:	PKW-024

T A B L E O F C O N T E N T S

Section	Coordinates
Special features, safety, use	02
Trouble-shooting chart	04
Self-diagnostics, self-diagnostics test table	07
Test specifications	25
Electrical terminal diagram, EDC	27
Installation position of components, instructions on removal and installation	see basic instructions

SPECIAL FEATURES

These brief instructions apply to the following Peugeot model current at the time of writing:

505 Turbo-Diesel
with electronic control of diesel fuel injection (EDC = Electronic Diesel Control)

Engine: XD3T 2.5 l, 70 kW (95 bhp)
EU, USA 03.87 ->

USE

These brief instructions essentially contain vehicle-specific special features and test specifications (nominal values).

The trouble-shooting chart leads to the various causes/component defects on the basis of the customer complaint.
Detailed instructions on trouble-shooting can be found using the trouble-shooting chart of the basic instructions.

NOTE:
The nominal values, terminal assignments, and special features of these vehicle-specific brief instructions are always binding even when reference is made to a basic instruction.

SAFETY AND PRECAUTIONARY MEASURES

Always observe these measures in order to prevent damage to the engine, control units and peripheral components of the EDC.

1. For testing the compression, disconnect the 7-pin connector from the disttributor-type-fuel injection pump.

2. In the case of nozzle-holder assemblies inductive start-of-injection sensor, the after-sales service workshop is permitted to perform only a correction of the nozzle-opening pressure.

3. Never start the engine if the battery is not firmly connected.

4. Do not use a fast charger for starting the engine.
   Provide starting assistance only using a second 12 V battery and jumper cables.

5. Before fast charging, disconnect the battery from the vehicle electrical system.

6. Never disconnect the battery from the vehicle electrical system when the engine is running.

7. Never disconnect or connect the control-unit plug when the ignition is switched on.

8. At temperatures above + 80° C (paint-drying installation), remove the control units.

9. When welding (electric spot welding), remove the control units.

TROUBLE-SHOOTING CHART

Customer complaint (symptom of trouble)

1. Trouble lamp lights up/blinks	2. Starting motor operates, engine does not start or starts only with difficulty (hot or cold)	3. Engine surges in idle	4. Uneven idle with engine warm	5. Excessive fuel consumption together with inadequate engine power and smoke formation	6. Unsatisfactory performance	7. Black smoke in full-load range together with rough engine running, poss. insufficient power	8. Rough engine running	Cause (component fault)
*								Self-diagnostics
	*							Voltage supply, control units
	*							Electromagnetic actuator for quantity
	*							Angle potentiometer
	*							ELAB
	*				*		*	Computer monitoring
					*		*	Solenoid-valve - start of injection
					*			EGR pressure transducer
					*			Nozzle-holder assemblies with NMS
					*			Computer linkage
		*					*	Engine-speed sensor
	*							Engine-speed sensor and NMS
	*							Tank empty, tank ventilation
	*		*			*		Injection sequence not ignition sequence
		*						Reducer bushing, supply/return flow
	*		*					Air in fuel system
	*							Paraffin deposits
	*			*				Leakage in fuel lines
	*							Supply lines blocked
	*		*	*		*	*	Fuel-injection nozzles
	*		*	*		*		Pump-engine coordination
	*							Fuel filter
	*							Preheating system
	*		*	*				Compression - engine
	*	*	*	*		*		Fuel-injection pump
				*				Engine air filter
				*				Engine timing
						*		Timing device
					*			Turbo-supercharger

Customer complaint (symptom of trouble)

9. Engine missing during vehicle operation
10. Engine cuts off automatically
11. Engine runs at constant speed
12. Engine will not rev up in cold condition
13. Increased idle speed or uneven engine running at high engine speeds
14. Black smoke in full-load range
15. Fog-like smoke (white) in full-load range

9	10	11	12	13	14	15	Cause (component defect)
	*						Accelerator pedal
*							Electromagnetic actuator for quantity
*			*				Angle potentiometer
*							Computer monitoring
*							Engine-speed sensor and NMS
*	*		*			*	Tank empty, tank ventilation
	*		*			*	Injection sequence not ignition sequence
*			*			*	Reducer bushings supply/return flow
*			*			*	Air in fuel system
			*				Paraffin deposits
*							Leakage in fuel lines
*			*			*	Supply lines plugged
			*			*	Pump-engine coordination
			*			*	Fuel filter
			*				Compression, engine
			*			*	Fuel-injection pump
					*		Exhaust-gas recirculation

Customer complaint (symptom of trouble)

16. Cruise control (FGR) not functioning
17. Cruise control cannot be switched off
18. Road speed cannot be reassumed
19. Exhaust-gas recirculation not functioning

16	17	18	19	Cause (component defect)
			*	Computer monitoring
			*	Solenoid-operated valve - start of inj.
			*	EGR pressure transducer
			*	Nozzle holders with NMS
*			*	Engine-speed sensor
*			*	Road-speed sensor
*				Transmission-shift valve
*				Cruise-control ON switch
*	*			Clutch/brake switch
	*			Cruise-control OFF switch
		*		Cruise-control ACTIVATE switch
			*	Air-flow sensor
			*	Temperature sensor - air
			*	Temperature sensor - engine

* Using the self-diagnosis

The control units of the electronically controlled diesel fuel injection (EDC = Electronic Diesel Control) have a self-diagnosis system at their disposal for the purpose of detecting defective peripheral components and/or line paths.

Therefore, always begin trouble-shooting (testing) with self-diagnosis.

If several faults are present and can be called up in turn via the self-diagnosis, make a note of the flashing-code data. If the voltage supply for the control units is interrupted, the faults stored are cleared. As a result, faults which momentarily cannot be registered (e.g. intermittently occuring loose contacts) cannot be identified as the cause of trouble.

If a faulty function path is indicated, pay particular attention to:

* Loose contacts at multiple plug
* Fouled, deformed or corroded plug-in contacts.
* Breaks in leads at kinked or pinched locations.

Test information:

Before disconnecting or connecting control-unit plugs, switch off the ignition.

Clear the flashing code of the fault stored and trigger self-diagnosis once again as a check.

An integrated self-diagnosis system in the two control units (output through control unit 2 only) makes it possible to locate a faulty component or line path via a flashing code. Indication is given by means of an indicator lamp in the instrument panel, this lamp lighting or flashing in the case of a fault (illustration a).

The diagnostic program is activated by pressing the diagnostic button (Test).

The program then starts with a start code 1.2 (= 1 flashing pulse - pause - 2 flashing pulses) and ends with an end code 1.1.

Flashing-code evaluation

1. Actuate the diagnostic button (Test) for at least 1 second in order to avoid incorrect tripping.

2. Start code 1.2 of the diagnosis program is indicated.

3. Wait until the indicator lamp lights up again and then actuate the test switch once again.

4. Flashing code of the corresponding faulty component is indicated.

5. Actuate the diagnostic button again. If there is no further fault, the end code 1.1 is indicated.

Clearing the flashing code

1. Switch on the ignition.

2. Actuate the brake pedal and test switch simultaneously for at least 1 second.

3. Call up the diagnosis program anew by pressing the diagnostic button.

4. If the end code 1.1 is indicated after the start code 1.2, the stored flashing code for the respective faulty component is cleared.

* Breakdown of self-diagnosis (flashing code)

1.1 Program end code
1.2 Program start code
1.3 Temperature sensor (intake air) *
1.4 Temperature sensor (coolant) *
1.5 Fuel-temperature sensor *
2.1 Accelerator pedal
2.2 Rotational-angle potentiometer
2.3 Delivery controller
2.4 Road-speed sensor *
2.5 Pressure transducer, road-speed control *
3.1 Atmospheric-pressure sensor *
3.3 Air-flow sensor
3.4 Pressure transducer, exhaust-gas recirculation
4.1 Engine-speed sensor
4.2 Needle-movement sensor
4.3 Solenoid-operated-valve start of injection
5.1 Computer interface, control unit (stored fault)
5.2 Computer interface, control unit (present fault) and/or computer monitoring, control unit 1

Steady light (flashing code cannot be called up)
Computer monitoring, control unit 2

N o t e:

* = Slight fault, indicator lamp of self-diagnosis goes out 30 seconds after the engine has been started.

SELF-DIAGNOSIS TEST TABLE

Defect-indic. Blink code	Test of component/function	Test instructions/conditions	Terms.	Nominal values
1.3	Temperature sensor (intake air)	Test resistance at air-flow sensor at +15...+30°C. Test measurement voltage (control unit) at disconnected cable connector.	1 – 4 1 – 4	1.3...3.6 k Ω approx. 5 V
1.4	Temperature sensor (coolant)	Test resistance at component. +15...+30°C: approx. 80°C: Test measuring voltage (control unit) at disconnected cable connector.		1.3...3.6 k Ω 250...390 Ω approx. 5 V
1.5	Temperature sensor, fuel	Carry out tests at 7-pin cable plug for the EDC-VE pump with the help of test adapter KDEP 1160 or KDEP 1165. * Ground connection Connect adapter to cable connector for fuel-injection pump * Short circuit Connect adapter to cable connector for fuel-injection pump * Internal resistance at +15...+30°C: (Connect adapter to cable connector for fuel-inj. pump) * Measuring voltage (control unit): (Connect adapter to cable connector for control unit)	 5 – gr. 6 – gr. 4 – 6 5 – 6 5 – 6	 > 1 M Ω > 1 M Ω > 1 M Ω 1.2...4.0 k Ω approx. 5 V
2.1	Accelerator pedal	Carry out tests on component. * Internal resistance * Supply voltage * Voltage signal – idle position – full-load position	 1 – 3 1 – 3 (–) (+) 1 – 2 1 – 2	 1.6...2.4 k Ω 4.8...5.2 V 0.45...0.55 V 4.00...4.50 V

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

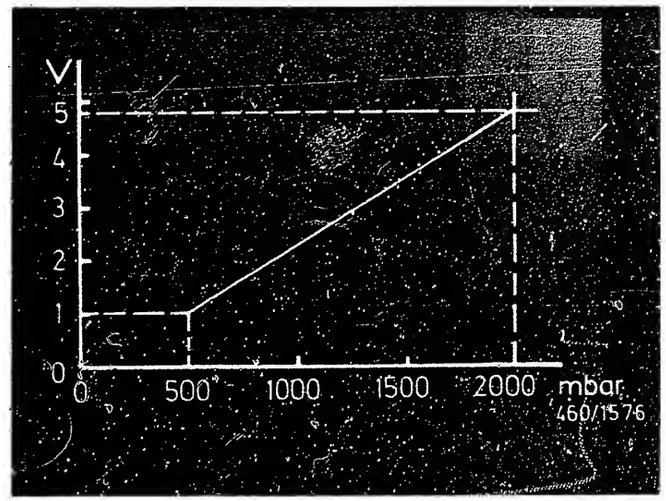
Defect-indic. Blink code	Test of component/function	Test instructions/conditions	Terms.	Nominal values
2.2	Angle potentiometer	Carry out tests at 7-pin cable connector of EDC-VE pump with the help of test adapter KDEP 1160 or KDEP 1165.		
		* Ground connection Connect adapter to cable connector for fuel-injection pump	1 - gr. 2 - gr. 3 - gr.	> 1 M Ω > 1 M Ω > 1 M Ω
		* Short circuit Connect adapter to cable connector for fuel-injection pump	2 - 7	> 1 M Ω
		* Resistance - potentiometer path Connect adapter to cable connector for fuel-inj. pump.	2 - 3	1.0...10.0 k Ω
		* Resistance - slider path Connect adapter to cable connector for fuel-inj. pump.	1 - 3	500 Ω ...5.00 k Ω
		* Supply voltage Connect adapter to cable connector for control unit.	2 - 3 (+) (-)	4.8...5.2 V
		* Voltage signal Connect both cable connectors to adapter. Disconnect cable connectors at temperature sensor 2 (engine) and needle-motion sensor (NMS).	1 - 3	2.0...2.3 V
		Plug in cable connector to NMS.		> 3.0 V

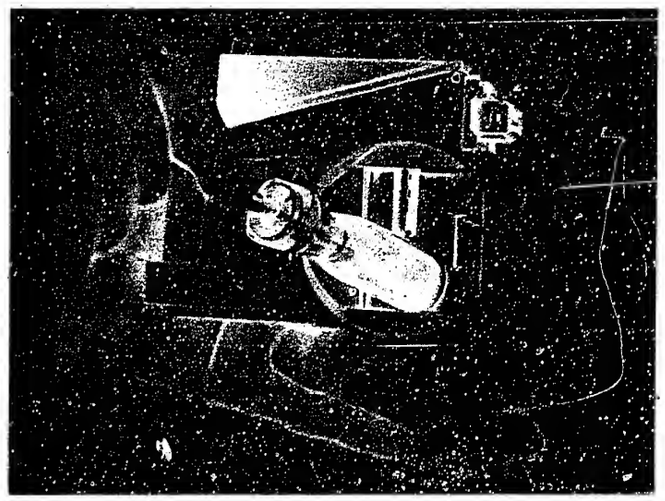
SELF-DIAGNOSIS TEST TABLE (CONTINUED)

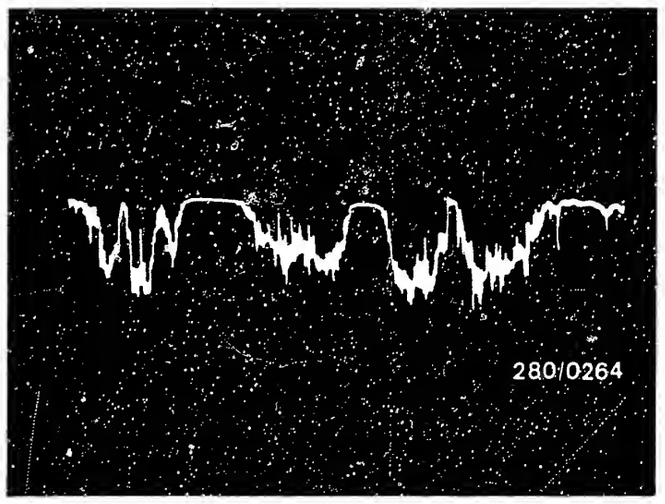
Defect-indic. Blink code	Test of component/function	Test instructions/conditions	Terms.	Nominal values
2.3	Quantity control	Carry out testing at 7-pin cable connector for EDC-VE pump with the help of test adapter KDEP 1160 or KDEP 1165.		
		* Ground connection Connect adapter to cable connector for fuel-inj. pump.	4 - gr. 7 - gr.	> 1 M Ω > 1 M Ω
		* Internal resistance Connect adapter to cable connector for fuel-inj. pump.	4 - 7	0.3...1.2 Ω
		* Supply voltage Connect adapter to cable connector for control unit.	3 - 7 (-) (+)	8.0...14.5 V
2.4	Road-speed sensor	Test internal resistance at components at +15...+50°C. Test measuring voltage (control unit) at disconnected cable connector.		240...350 Ω approx. 5 V
2.5	Cruise-control pressure transducer	Test internal resistance at components at approx. +20°C. Test measuring voltage (control unit) at disconnected cable connector.		5.0...6.0 Ω approx. 12 V

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Defect-indic. Blink code	Testing of component/function Test instructions/conditions	Terms.	Nominal values
3.1	Atmospheric-pressure sensor. Carry out testing at component. * Supply voltage * Voltage signal (find out barometric pressure)	 1 - 3 1 - 2	 4.8...5.2 V see characteristic curve
3.3	Air-flow sensor. Carry out testing at component. * Overall resistance * Supply voltage * Voltage signal - By changing the air-flow sensor flap position * Noise test - Motortester, special input	 3 - 4 3 - 4 (+) (-) 2 - 4 2 - 4	 500...1000 Ω 4.8...5.2 V 0.25...4.65 V Noise signal in case of defective air-flow sensor (see illustration)
3.4	Exhaust-gas recirculation press. transd. * Test internal resistance at component at approx. + 20°C. * Test measuring voltage (control unit) at component cable connector * Actuation on-off ratio - Coolant temperature approx. + 80°C - Connect pocket tester to pressure transducer - Set for dwell angle - Operate engine at idle speed - Disconnect cable connector at temperature sensor (coolant) or air-flow sensor. Note for testing: The on-off ratio should change when one of the components is unplugged.		5.0...6.0 Ω approx. 12 V Tester shows the on-off ratio 0...10 %

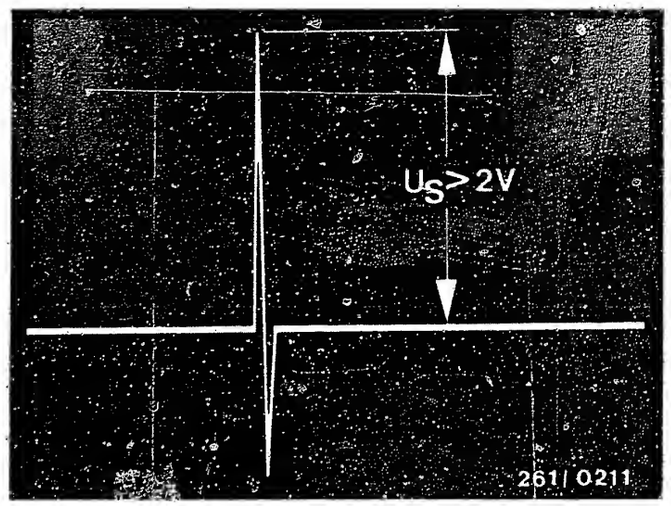


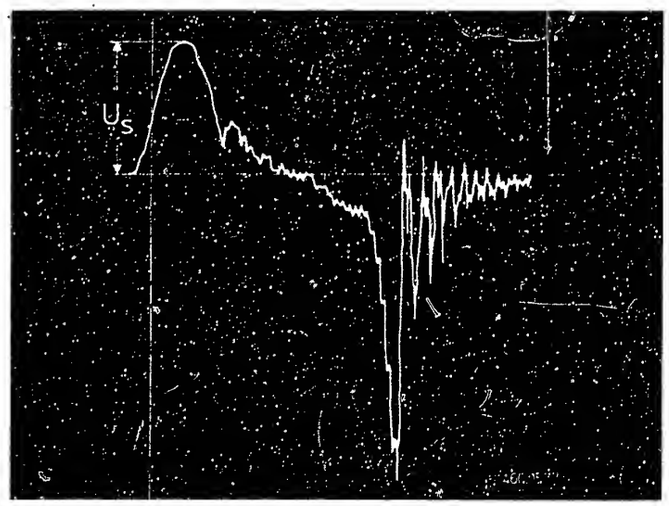




SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Defect-indic. Blink code	Testing of component/function Test instructions/conditions	Terms.	Nominal values
4.1	Engine-speed sensor Carry out tests on component cable connector. * Ground connection * Internal resistance at approx. + 20°C * Engine-speed signal image – Motortester, special input – Operate engine at idle speed Note: Positive signal peak must come first	 1 – 2 (+) (–)	 > 1 M Ω 900...1100 Ω see upper signal image
4.2	Needle-motion sensor – carry out tests on component cable connector. * Ground connection * Internal resistance approx. + 20°C approx. + 80°C * Supply voltage – Cable connector disconnected – Cable connector connected at approx. + 80°C * Valve-lift signal/signal voltage (U_s) – Cable connector connected – Operate engine at idle speed – Motortester special input, or use oscilloscope		 > 1 M Ω 90...110 Ω 111...135 Ω 10.0...12.0 V 2.5... 6.0 V See signal image U_s = > 150 mV





SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Defect-indic. Blink code	Testing of component/function	Test instructions/conditions	Terms.	Nominal values
4.3	Start-of-injection solenoid-operated valve	Carry out testing on component cable connector.		
		* Ground connection		> 1 M Ω
		* Internal resistance at approx. +60°C		13.0...22.0 Ω
		* Test measuring voltage (control unit) at disconnected cable connector.		approx. 12 V
		* Actuation on-off ratio		
		– Coolant temperature approx. + 80°C		
		– Connect pocket tester to connected cable connector		10...30 %
		– Set for dwell angle		
		– Operate engine at idle speed		
		– Unplug cable connector from needle-motion sensor		
		– Plug in cable connector to needle-motion sensor		20...40 %
		Note for testing: The on-off ratio should change when the needle-motion sensor plug is disconnected or when the engine speed increases		
5.1	Computer link, control unit (fault in memory)	Fault not occurring at time of testing. Disconnect control-unit plugs 1 and 2. Test the following leads for open circuits or contact resistance: Control-unit plug 1 — Control-unit plug 2 Term.14 to term.9 Term.15 to term.12		approx. 0 Ω

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Defect indic. Blink code	Testing of component/function	Test instructions/conditions	Terms.	Nominal values
5.2	Computer linkage, control unit (current fault)	Fault is present at time of testing. Disconnect cable connector at control-unit plugs 1 and 2. Test the following leads for open circuits and/or contact resistance: Control-unit plug 1 — Control-unit plug 22 Term.14 to term.9 Term.15 to term.12		approx. 0 Ω
5.2	Computer monitoring, control unit 1	There is a defect in the computer monitoring only if the engine <u>cannot</u> be started with the indicated blink code. Replace control unit 1.		
Continuour light	Computer monitoring, control unit 2	Self-diagnosis indicator lamp lights up and stays lit, and no blink code is indicated when the test button is pressed. Exhaust-gas recirculation switched off. Disconnect cable connector from start-of-injection solenoid-operated valve. Test measuring voltage (control unit) at cable connector.		approx. 12 V

TEST SPECIFICATIONS

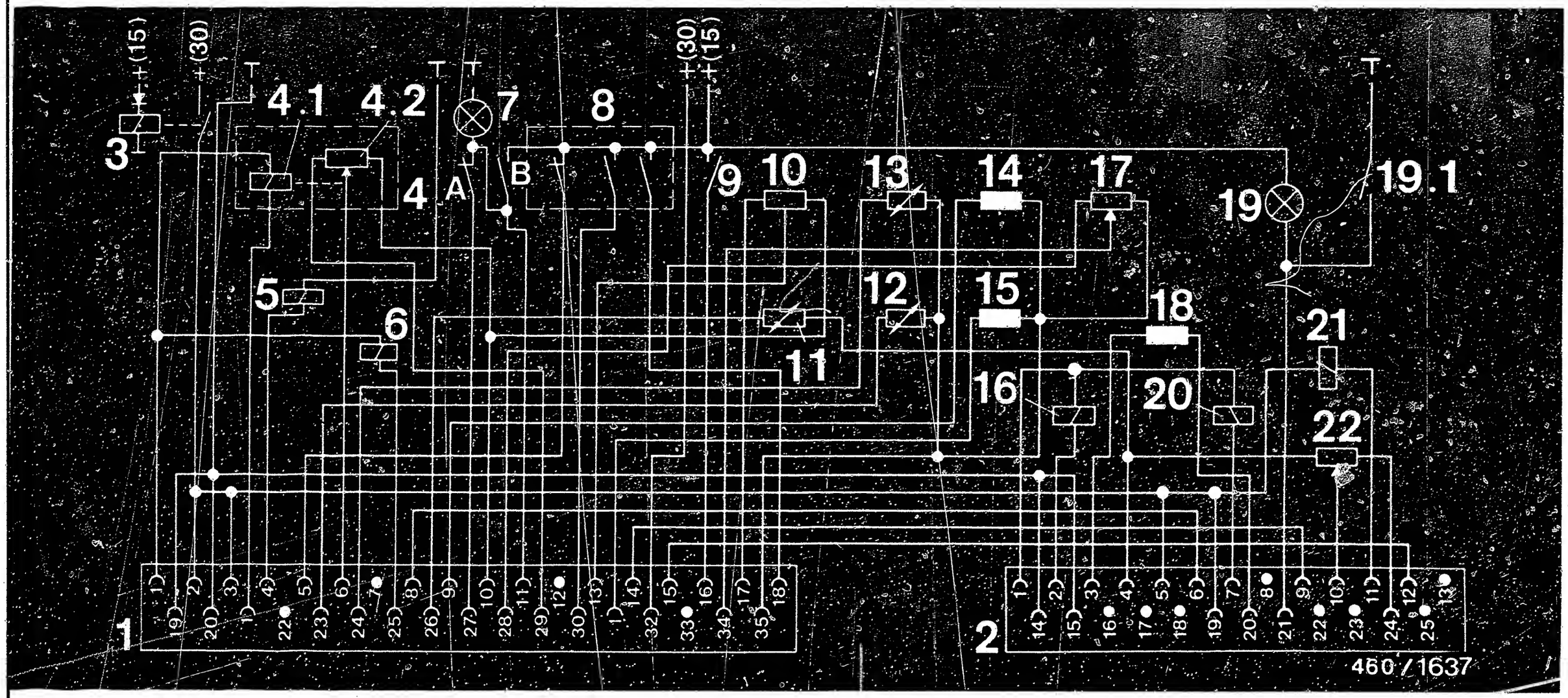
Component/function	Nominal values
Idle speed:	
* Eng. at op. temp. (approx. +80°C)	730... 830 min $^{-1}$
* Engine cold	950...1050 min $^{-1}$
Nozzle-opening pressure:	150 + 8 bar
Coordination of pump and engine:	
Setting value engine position	4th cylinder 1.07 mm before TDC
Inspection value engine position	4th cylinder 1.04...1.10 mm before TDC
Setting value pump position	0.30 mm after BDC
Inspection value pump position	0.28...0.32mm after BDC
Charge-air pressure:	0.8 bar at full load starting at 2000 min $^{-1}$
Compression:	25...30 bar
Max. cylinder deviation	5 bar

TEST SPECIFICATIONS (CONTINUED)

Component/function	Nominal values
Valve clearance - exhaust - intake	0.25...0.30 mm 0.15...0.20 mm
Engine temperature approx. + 20°C	
Filter test, max. allowable differential pressure:	0.3 bar
Pressure drop:	max. perm. 25 %
Transmission-shift valve Internal resistance	28...32 Ω

Tightening torques

Fuel lines	25 Nm
Fastening screws/ fuel-injection pump	20 Nm
Fastening screws/nozzle-holder assemblies	70 Nm
Sheathed-element glow plugs	25 Nm
Screw plug	15 Nm
Adjusting screw - rocker arm	15 Nm
Fastening nut/ crankshaft belt pulley	170 Nm
Cylinder-head cover screws	7.5 Nm



A = Switch, clutch
B = Switch, brakes
1 = Quantity/road-speed control unit (1)
2 = EGR/start-of-injection control unit (2)
3 = Reversed-polarity protection relay
4 = Fuel-injection pump
4.1 = Quantity actuator
4.2 = Actuator potentiometer
5 = ELAB
6 = FGR pressure transducer *
7 = Stop lamps
8 = FGR operating stalk
9 = Air conditioner
10 = Accelerator pedal
11 = Temperature sensor, intake air
12 = Temperature sensor, coolant
13 = Fuel-temperature sensor
14 = Road-speed sensor
15 = Engine-speed sensor
16 = Timing device
17 = Atmospheric-pressure sensor
18 = Needle-motion sensor (NMS)
19 = Diagnostic display
19.1 = Diagnosis request
20 = EGR pressure transducer
21 = transmission-shift valve *
22 = Air-flow sensor

* = only on vehicles with automatic transmission

ELECTRICAL TERMINAL DIAGRAM – EDC

C27 ⟹ C28 ⟸

Trouble-shooting instructions : OPE-5000

BOSCH system : L3.1-Jetronic

Make of vehicle : OPEL

Basic microcard : PKW-044

TABLE OF CONTENTS

Section	Coordinates
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SPECIAL FEATURES

These brief instructions, valid at the time of publication, are valid for the following vehicle models with 1.796 1/4-cyl. engine:

OPEL Omega-A 1.8 Injection		EU	09.86->
VAUXHALL Astra	Right-hand drive	GB	09.86->
VAUXHALL Cavalier	Right-hand drive	GB	09.86->

* L3.1-Jetronic with 15-pin control unit: 0 280 000 603/604 and ...605/606. Activated by term.5 of the spark-advanced mechanism.

* In place of the main and pump relays, one double relay for voltage supply.

* Throttle-valve switch, idle contact and full-load contact are used also for spark-advance mechanism EZ 61.

* For testing the fuel pressure, use the pressure gauge and hose lines of the pressure measuring instrument KDJE-P 100.

* Connect 3-way line KDJE-P 100/13 between the fuel feed line and pressure damper.

STRUCTURE, USAGE

These brief instructions essentially cover the vehicle-specific special features and test specifications (set values).

Corresponding to the customer complaint, the trouble-shooting chart leads to various causes/component faults.
Detailed instructions for trouble-shooting must be taken from the basic instructions via the trouble-shooting chart.

NOTE: Even if reference is made to basic instructions, the set values, terminal assignments and special features in these vehicle-related brief instructions are always binding.

The numbering of the test steps is the same for both the brief and basic instructions in order to make it easier to find individual test steps.

SAFETY AND PRECAUTIONARY MEASURES

Keep people out of danger.
Avoid damage to the engine, control unit or ignition system.

* C A U T I O N !
  High-performance ignition system.
  Dangerous high and low voltages.

  Do not come into contact with parts or terminals which carry voltage; danger, primary and secondary sides.

* Avoid injection when testing the compression.
  Therefore, disconnect the double relay.

See basic instructions for further precautionary measures.

TROUBLE-SHOOTING CHART

Customer complaint (symptom of trouble)

1. Starting motor operates, but engine fails to start or starts with difficulty.	2. Engine starts but then dies.	3. Rough idling (Speed, exhaust).	4. Poor throttle response, poor progression.	5. Engine misfiring (Ignition, injection).	6. Engine lacks power/ maximum speed not obtained.	7. Fuel consumption too high.	8. Engine diesels.	9. Engine pings/knocks.	10. Engine overheats.	11. Fault lamp.	Cause (component fault)
*	*	*	*	*	*	*			*		Universal test adapter
*	*	*	*		*						Air intake system
*	*	*	*								Auxiliary-air device
*		*	*	*	*	*					Air-flow sensor
				*	*						Quantity of fuel
*	*	*	*		*	*	*				Fuel pressure, leakage
		*									Pump noises
		*		*	*	*	*				Solenoid-operated injection valves
				*							Generator, interference suppression
*	*	*				*					Starting control
				*		*					Overrun cut-off
		*	*	*		*					Engine-speed adjustment, CO adjustment

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01
Adapter lead: 1 684 463 168

Test step	Switch V	Switch Ω	Term.	Checking of components/operation	Test instructions/ test conditions	Set values
1	| V	5	8 – 5	Resistance, temperature sensor (engine)	Connect control-unit plug only Engine temperature +15...+30 °C: approx. +80 °C:	 1.45...3.3 k Ω 280...360 Ω
2	| V	6	4 – 5	Ground of output stage		0...10 Ω
3	–	–	–	Not applicable		
4	| V	9	15 – 5	Resistance of throttle-valve switch (idle)	Pull off plug from spark-advance mechanism Throttle valve closed: Throttle valve open :	 0...10 Ω infinite Ω
5	| V	10	14 – 5	Resistance of throttle-valve switch (full load)	Plug remains disconnected Throttle valve closed : Throttle valve fully open:	 inifinite Ω 0...10 Ω
6	5	10	1 – 5 (+) (–)	TN signal from spark-advance mech. term.5	Connect plug onto spark-advance mechanism Transmission in neutral position, start engine	Rectangular pulse on oscilloscope
7	6	10	2 – 5 (+) (–)	Voltage supply of control unit	Switch on ignition	8...15 V
8	7	10	12 – 5 (+) (–)	Winding term. 85b/87 of double relay	Switch on ignition	8...15 V

D05 —⟹
D06 —⟺

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (continued)
Adapter lead: 1 684 463 168

Test step	Switch V	Switch Ω	Term.	Testing of components/operation	Test instructions/ test conditions	Set values
9	7	10	12 – 5	Simulation, activation of electric fuel pump	Pull off lead plug from auxiliary-air device Switch on ignition Press test button 3	Electric fuel pump running, check by listening
9.1	7	10	12 – 5	Simulation, activation of auxiliary-air device	Connect lead plug onto auxiliary-air device Switch on ignition Press test button 3	Restriction closes air-gap area, visual examination
10	7	10	12 – 5 (+) (–)	Ground connection of double relay term.85b via control unit	Connect control unit too Transmission in neutral position, start engine Operate engine at idle speed	0...5 V
11	8	10	11 – 5 (+) (–)	Air-flow signal UP output term.11	Leave engine running	0...5 V depending upon load
12	–	–	–	Not applicable		
13	10	10	3 – 5 (+) (–)	Injection pulses from control unit	Leave engine running	Injection pulses on oscilloscope
14	11	10	10 – 5 (+) (–)	Load signal TL output term.10	Leave engine running	TL rectang. pulses depending upon load
15	12	10	9 – 5 (+) (–)	Reference voltage UV output term.9	Leave engine running	3.5...4.5 V
16	10	10	3 – 5 (+) (–)	Simulation, engine cold	Leave engine running, press test button 1	Injection pulse wider or engine speed lower

D07 — ⟺

D08 — ⟺

RAPID DIANOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (continued)
Adapter lead: 1 684 463 168

Test step	Switch V	Switch Ω	Term.	Testing of components/operation	Test instructions/ test conditions	Set values
17	10	10	3 – 5 (+) (–)	Simulation, engine warm	Leave engine running, press test button 2	Injection pulse must not become wider
18	10	10	3 – 5 (+) (–)	Simulation, overrun cut-off	Leave engine running, engine speed above 2000 min^{-1} Press test button 5	No injection pulse, engine hunts
19	10	10	3 – 5 (+) (–)	Simulation, full-load adjustment	Leave engine running, engine speed approx. 2200 min^{-1} Press test button 6	Low injection pulse and/or change of engine speed.

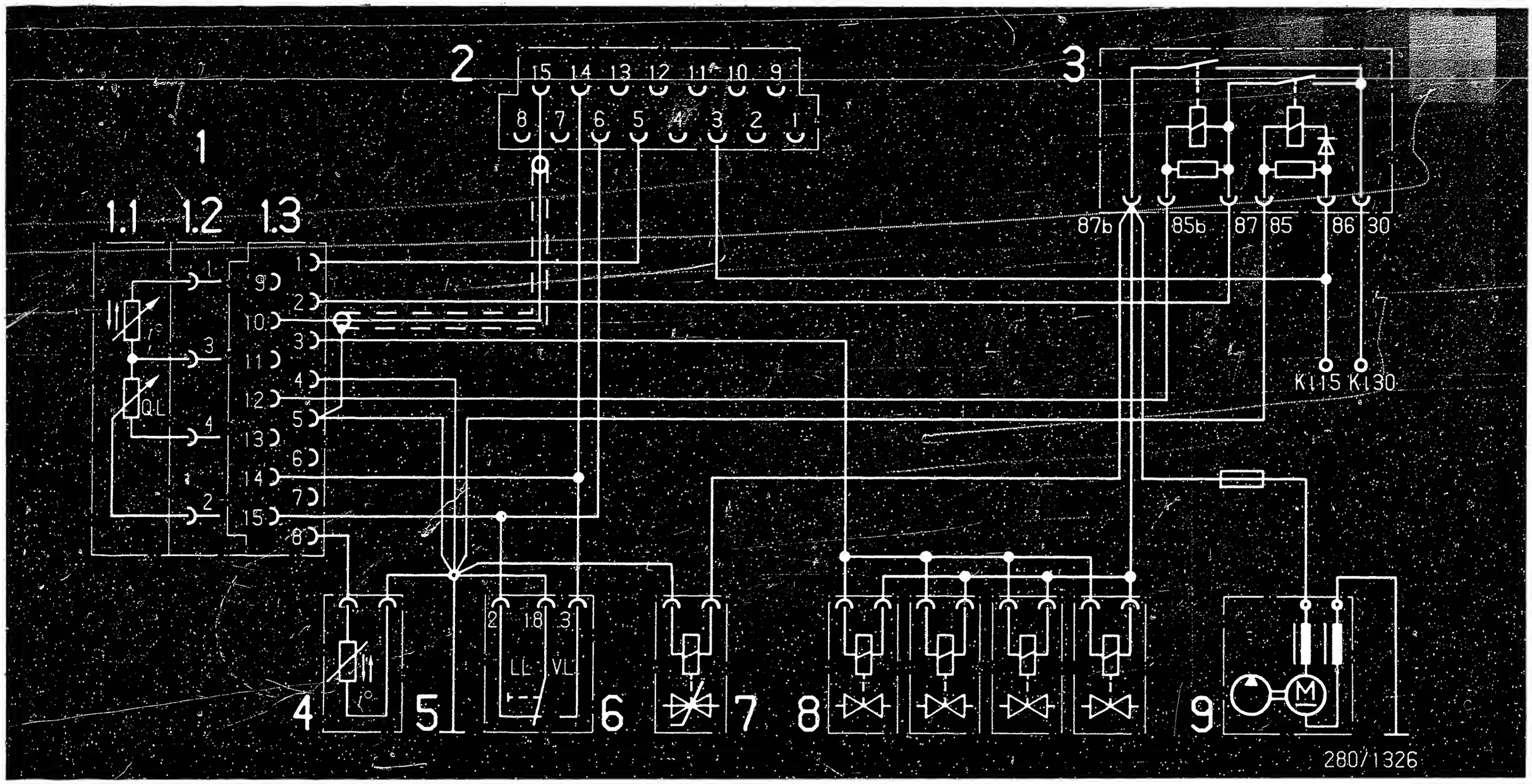
TEST SPECIFICATIONS

Components/operation	Set values
Electric fuel pump	
* Fuel delivery at return:	at least 700 cm ^{3} /30 s
* Supply voltage under load:	at least 12V
Pressure regulator	
* Fuel pressure	
with engine not running:	2,3...2,7 bar
at idle speed:	approx. 0.5 bar lower
Fuel system, leakage	
* Fuel pressure 20 min. after engine switched off:	at least 1.0 bar
Auxiliary-air device	
* Internal elec. resistance:	30...65 Ω
Air-flow sensor, only measurable if control unit is removed.	
* Resistance value between	
term.3- and term.4- :	500...1000 Ω
term.3- and term.2- :	
Air-flow sensor flap in rest position	10...200 Ω
When air-flow sensor flap is deflected, indication must change:	
Temperature sensor (intake air), only measurable if control unit is removed.	
* Internal electrical resistance, between term.3- and term.1-, at ambient temperature +15...+30 °C:	1.45...3.3 k Ω

Test specifications (continued)

Components/operation	Set values
Temperature sensor (engine)	
* Internal electrical resistance at ambient temperature	
+15...+30 °C:	1.45...3.3 k Ω
with engine at norm. op. temp. approx. +80 °C:	280...360 Ω
Solenoid-operated injection valve	
* Internal electrical resistance at ambient temperature	
+15...+30 °C:	14,5...17,0 Ω
* Leakage after 60 s:	No drop must fall
Starting control	
*Voltage at injection valve	
on starting:	approx. 1.5 V
after approx. 15 s	approx. 0.5 V
Overrun cut-off	
* Reinstatement speed	
+15°...+30°C:	approx. 1600 min $^{-1}$
approx. +80°C:	approx. 1200 min $^{-1}$
Idle-speed adjustment Eng. at norm. op. term., +80°C	
* Idle speed:	850...900 min $^{-1}$
* CO concentration:	0,4...1,0 % by vol.

See equipment and Autodata microcard for settings for ignition, valve clearance and other engine-related data.



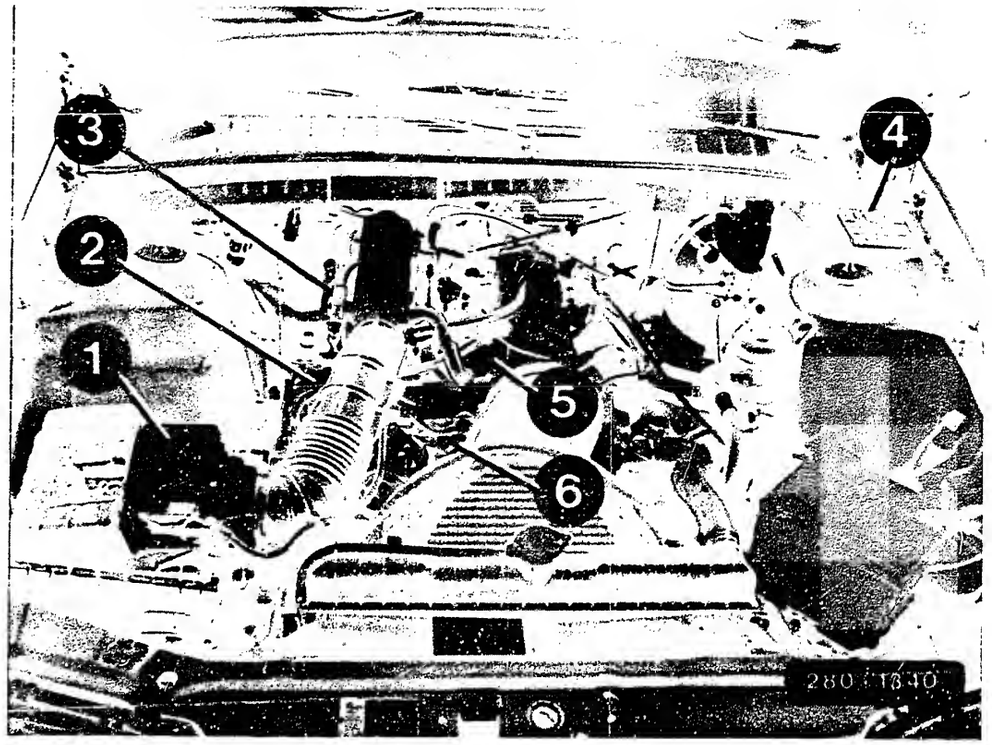
ELECTRICAL TERMINAL DIAGRAM

1 = Measuring and control assembly
1.1= Air-flow sensor with temperature sensor (intake air)
1.2= Control unit
1.3= Control-unit plug, 15-pin
2 = Spark-advance mechanism
3 = Double relay
4 = Temperature sensor (engine)
5 = Central ground (elec. and output stage)
6 = Throttle-valve switch (idle and full load)
7 = Auxiliary-air device
8 = Solenoid-operated injection valves
9 = Electric fuel pump

D13 ⟹

D14 ⟸

For production reasons:
continued on the following
coordinate.

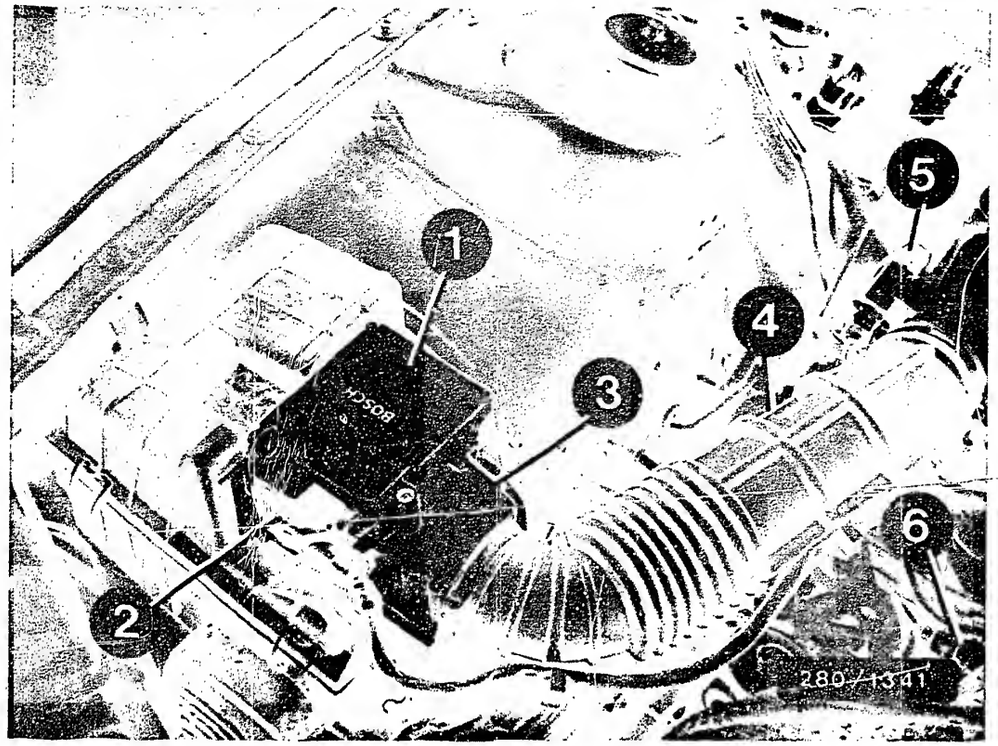


INSTALLATION POSITION OF COMPONENTS

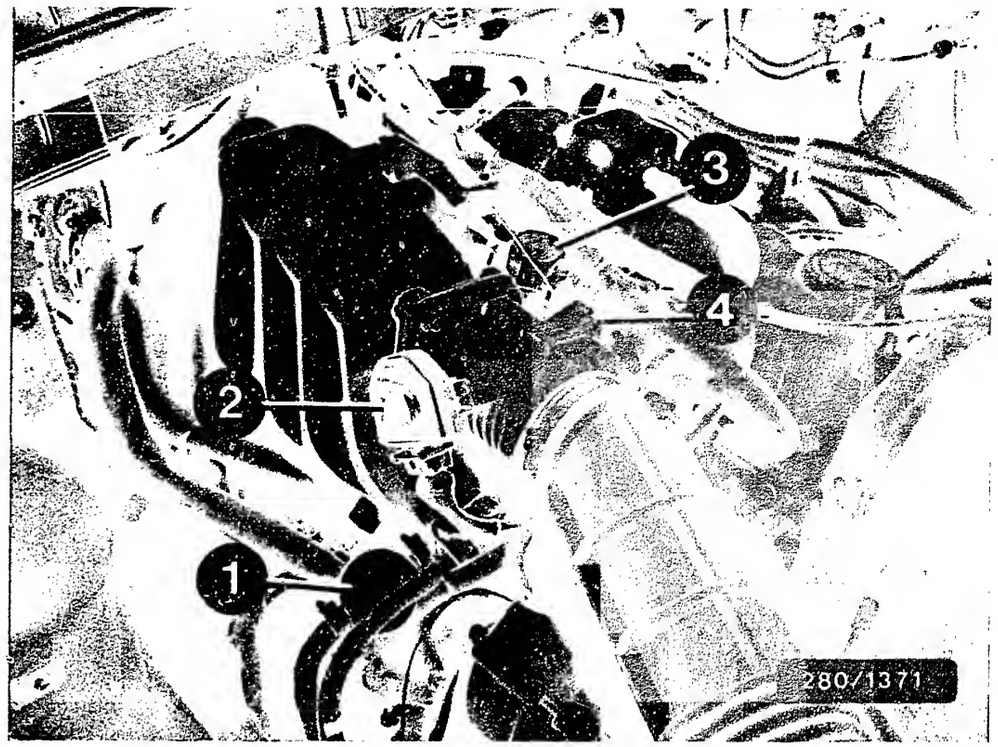
The indications "right" and "left" refer always to the forward direction of travel.

Arrangement of components in engine compartment.

1 = Measuring and control unit
2 = to pressure damper
3 = Throttle-valve switch
4 = Double relay (under cover)
5 = Auxiliary-air device
6 = Temperature sensor (engine)



1 = Measuring and control unit consisting of air-flow sensor and control unit
2 = 15-pin control-unit plug
3 = CO adjusting screw with anti-tamper cap
4 = to pressure damper
5 = Throttle-valve switch
6 = Temperature sensor (engine)



1 = Pressure damper
2 = Throttle-valve switch
3 = Auxiliary-air valve
4 = Idle-speed bypass screw

*The double relay is positioned beneath a covering behind the left-hand McPherson strut dome.

When testing, e.g. fuel delivery or fuel pressure, the safety circuit must be bridged. Pull off double relay, connect cable link between term.87b and term.30 into connection base. Electric fuel pump must run.

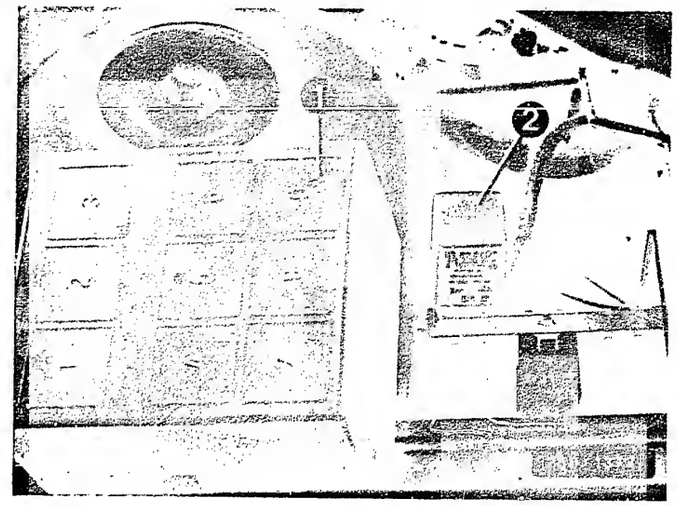
Further installation positions

*Connect the solenoid-operated injection valves between fuel-distribution pipe and intake manifold.

*The central ground is secured on the right at the front on the valve housing. (Near to auxiliary-air device).

Components of fuel-supply system

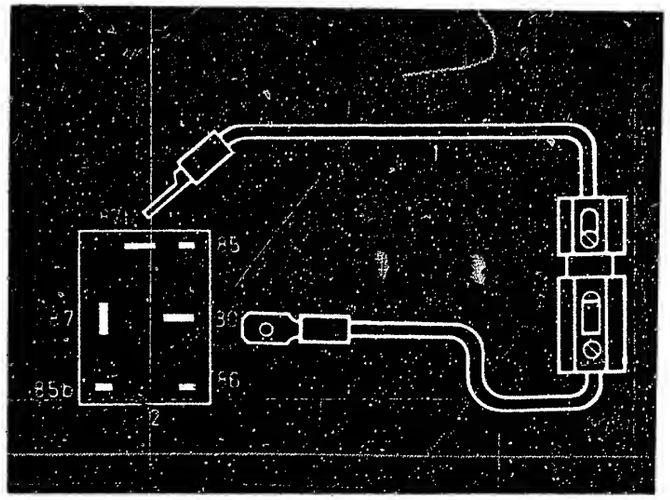
*Electric fuel pump, pressure damper and fuel filter are secured on the vehicle floor panel, on the right in front of the fuel tank.



1 = Covering
2 = Double relay

1 = Jumper with fuse holder and 10 A fuse (user-fabricated)

2 = Top view of connection base



Trouble-shooting instructions : PEU-5003

BOSCH system : EI - K

Make of vehicle : PEUGEOT

Basic microcard : PKW-045

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Special features, safety, usage	02
Trouble-shooting chart	04
Self-diagnosis	07
Rapid diagnosis chart	09
Test specifications	13
Electrical terminal diagram	15
Installation position of components	17

SPECIAL FEATURES

These trouble-shooting instructions apply to the following Peugeot models, valid at the time of compilation:

Peugeot 505 V 6 with the XN 3 J engine (with and without catalytic converter).

* EI-K ignition system with self-diagnosis (only knock control).
* Trigger box 0 227 100 124
* EI-K control unit 0 227 400 120/ 0 227 400 121.
* Ignition coil 0 221 118 387
* Knock sensor 0 261 231 007
* Engine-speed sensor 0 261 210 029
* Joint coolant-temperature sensor (double NTC) for ignition and fuel induction.

USAGE, STRUCTURE

These brief instructions mainly comprise vehicle-specific special features and test specifications (set values).

The trouble-shooting chart leads the way to various causes/component faults in accordance with the customer complaint.
Detailed instructions on trouble-shooting are to be taken from the basic instructions via the trouble-shooting chart.

NOTE: Even if reference is made to basic instructions, the set values, terminal connections and special features in these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

Keep people clear of danger.
Avoid damage to the engine, trigger box and ignition system.

* WARNING!
  Increased-power ignition system.
  Dangerous high and low voltages.

  Do not touch live parts or terminals; danger in primary and secondary circuits.

* For compression test, remove trigger-box plug or connect ignition coil term. 4 firmly to ground with auxiliary cable.

  Note:
  Suppression of auxiliary cable min. 2 kΩ.

For further precautionary measures, see basic instructions.

TROUBLE-SHOOTING CHART

Customer complaint (fault symptom)

1. Starting motor operates, but engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Rough idling (engine speed, exhaust gas).
4. Poor throttle response, flat spot during acceleration.
5. Misfiring (ignition, fuel injection).
6. Engine lacks power/ low maximum speed.
7. Fuel consumption too high.
8. Engine runs on.
9. Engine pings/knocks.
10. Engine becomes too hot.
11. Fault lamp.

1	2	3	4	5	6	7	8	9	10	11	Cause (component fault)
										*	Self-diagnosis
*		*	*	*							High-voltage side
*		*	*	*							Ignition coil
*											Firing sequence
*											Voltage, trigger box
*											Voltage, primary circuit
*											Voltage, EI-K control unit
*											Engine-speed sensor
*											Operation of EI-K control unit
*											Engine-speed signal (Jetronic)

TROUBLE–SHOOTING CHART

Customer complaint (fault symptom)

1. Starting motor operates, but engine fails to start or starts only with difficulty.	2. Engine starts but then dies.	3. Rough idling (engine speed, exhaust gas).	4. Poor throttle response, flat spot during acceleration.	5. Misfiring (ignition, fuel injection).	6. Engine lacks power/low maximum speed.	7. Fuel consumption too high.	8. Engine runs on.	9. Engine pings/knocks.	10. Engine becomes too hot.	11. Fault lamp.	Cause (component fault)
*				*							Contact resistances
		*	*		*	*					Throttle–valve switch – idle
						*			*		Throttle–valve switch – full load
										*	Fault lamp
		*	*		*	*		*	*	*	Spark–advance angle
				*							Voltage, EI–K control unit
				*							Voltage, trigger box
				*							Voltage, ignition coil
				*							Primary voltage

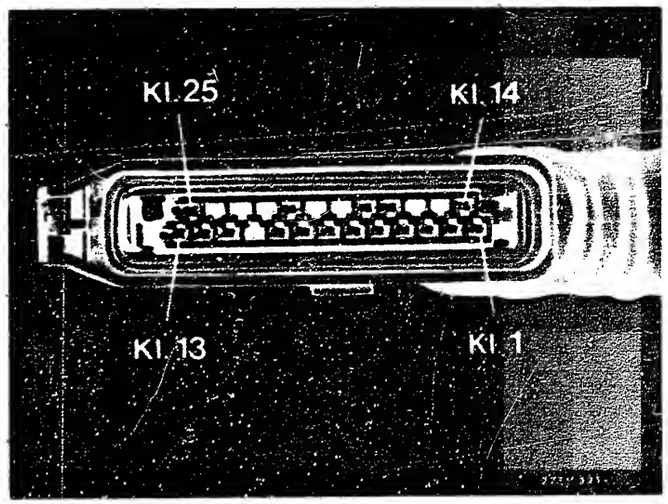
E05 — <==

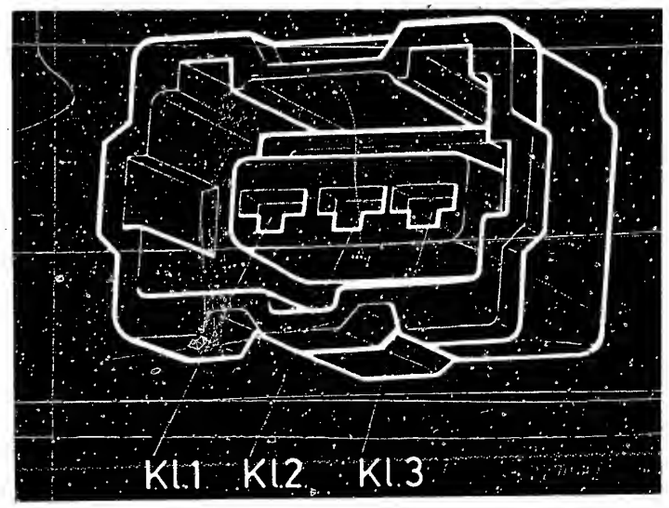
For production reasons: continued on the following coordinate.

E06 — => <=

SELF-DIAGNOSIS TEST TABLE

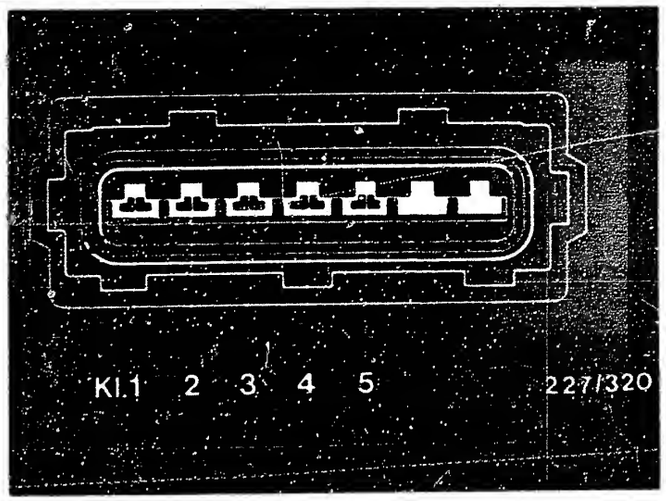
Fault ind. Flash code	Testing components/operation Test instructions/conditions	Terms.	Set values
2	Coolant-temperature sensor Resistance, EI-K control-unit plug at temperature + 20° C + 30° C + 80° C + 90° C + 100° C	2 , 20	 2,1...2,9 k Ω 1,4...2,0 k Ω 280...390 Ω 210...280 Ω 160...210 Ω
4	Knock sensor defective 1. Check both knock-sensor plug connections for oxidation. 2. Resistance, EI-K control-unit plug and left-hand knock-sensor plug connection (cyl. 1,2,3) 3. Resistance, EI-K control-unit plug and right-hand knock-sensor plug connection (cyl. 4,5,6) 4. Resistance, EI-K control-unit plug	 13 , 1 12 , 2 25 , 1 24 , 2 25 , 24 13 , 12	 approx. 0 Ω approx. 0 Ω approx. 0 Ω approx. 0 Ω infinite Ω infinite Ω
5	LH-Jetronic load signal Resistance, EI-K control-unit plug and LH-Jetronic control-unit plug Voltage, EI-K control-unit plug with handle cover removed	8 , 24 8 , 20 (+) (-)	approx. 0 Ω 0,1...1,0 V
6	Cylinder recognition pickup Resistance, EI-K control-unit plug Resistance, EI-K control-unit plug	18 , 19 19 , 21	approx. 0 Ω infinite Ω

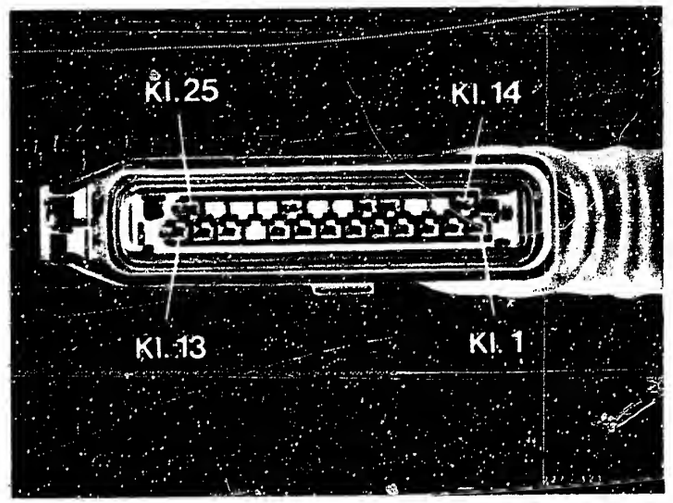


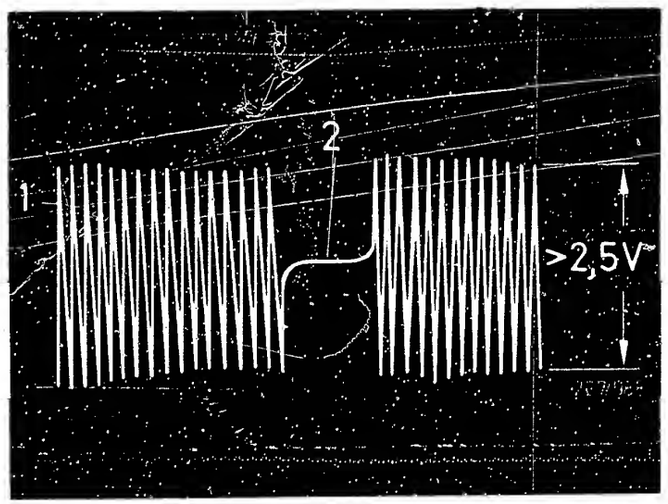


RAPID DIAGNOSIS CHART

Test step	Testing components/operation Test instructions/conditions	Terms.		Set values
1	HIGH-VOLTAGE SIDE visual examination (distributor cap, ignition wiring etc.) Ignition oscilloscope pattern	———		———
2	IGNITION COIL visual examination, plug in place, sealing compound escaped? Resistance, primary Resistance, secondary	 1 1	 15 4	 0,6...1,0 Ω 6,4...11,1 k Ω
3	POWER SUPPLY, TRIGGER BOX Ignition ON. Voltage, trigger-box plug	4 +	2 –	approx. U_B
4	PRIMARY CIRCUIT Igniton ON. Voltage, trigger-box plug	1 +	2 –	approx. U_B
5	POWER SUPPLY, EI-K CONTROL UNIT Ignition ON. Voltage, EI-K control-unit plug	6 +	20 –	approx. U_B
6	ENGINE-SPEED SENSOR 1. Resistance, EI-K control-unit plug 2. Resistance, EI-K control-unit plug 3. Start engine. Signal EI-K control-unit plug	 10 11 10 –	 23 23 23 +	 445...790 Ω infinite Ω For signal, see bottom picture.
7	EI-K CONTROL UNIT, OPERATION Start engine. Measuring signal, trigger-box plug and negative terminal of battery	16 +	B- –	Rectangular pulses
8	ENGINE-SPEED SIGNAL Start engine. Measuring signal, LH-Jetronic control-unit plug and negative terminal of battery	1 +	B- –	Rectangular pulses



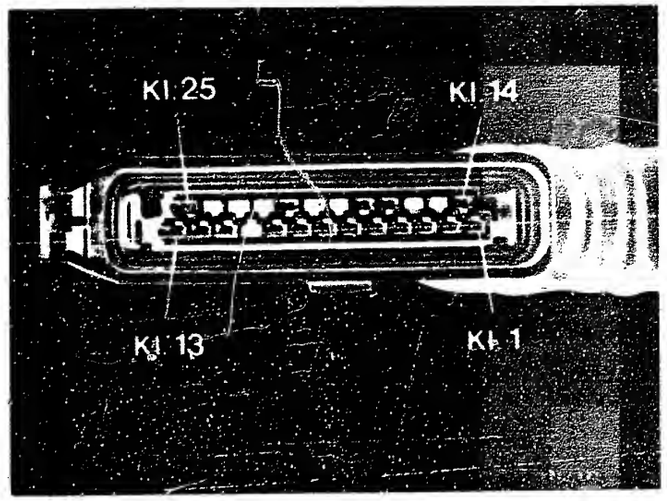


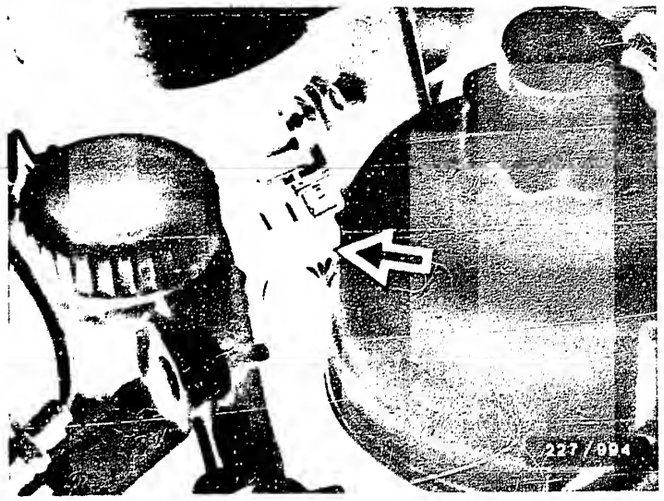


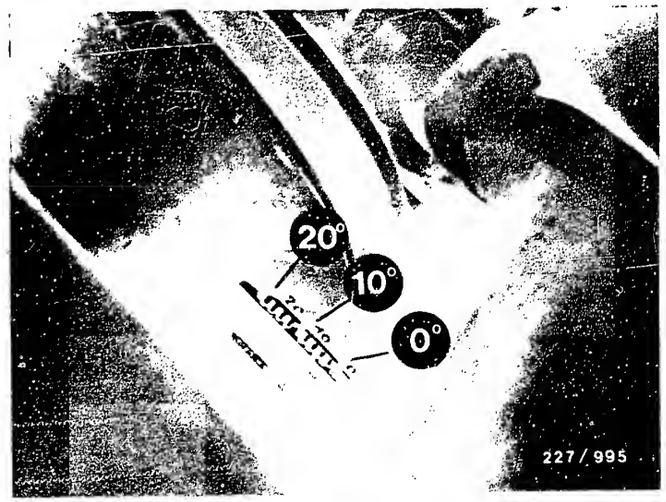
RAPID DIAGNOSIS CHART (continued)

Test step	Testing components/operation Test instructions/conditions	Terms.	Set values
9*	CONTACT RESISTANCES Check contact resistance of power-supply lines from trigger box/primary circuit.	———	max. 0.3 Ω
10	THROTTLE-VALVE SWITCH, IDLE Resistance, EI-K control-unit plug Throttle-valve in idle position	7 , 20	approx. 0 Ω
11	THROTTLE-VALVE SWITCH, FULL LOAD Resistance, EI-K control-unit plug Throttle valve fully open	4 , 20	approx. 0 Ω
12	FAULT LAMP Ignition ON. Fault lamp must light up. Engine at idle. Fault lamp goes out or flashes.	———	Fault lamp flashing: Assess flash code
13	POWER SUPPLY, TRIGGER BOX Engine idle. Voltage, trigger-box plug with rubber sleeve pushed back (arrow, center picture).	4 2 + –	12...14 V, max. 1 V below U_B
14	POWER SUPPLY, EI-K CONTROL UNIT Engine idle. Voltage, EI-K control-unit plug with handle cover removed	6 20 + –	12...14 V, max. 1 V below U_B
15	POWER SUPPLY, IGNITION COIL Engine idle. Voltage, ignition coil and vehicle ground	15 31 + –	min. 10 V
16	SPARK-ADVANCE ANGLE Engine at idle Spark-advance angle with EI-K con. unit ...121 Spark-advance angle with EI-K con. unit ...120	———	 9...13° BTDC 15...19° BTDC
17	OUTPUT STAGE Ignition ON. Voltage, ignition coil	15 1 + –	0 V
18	PRIMARY VOLTAGE Voltage, ignition coil with engine at idle	15 1 + –	290...370 V

* Only to be carried out when engine is not running.





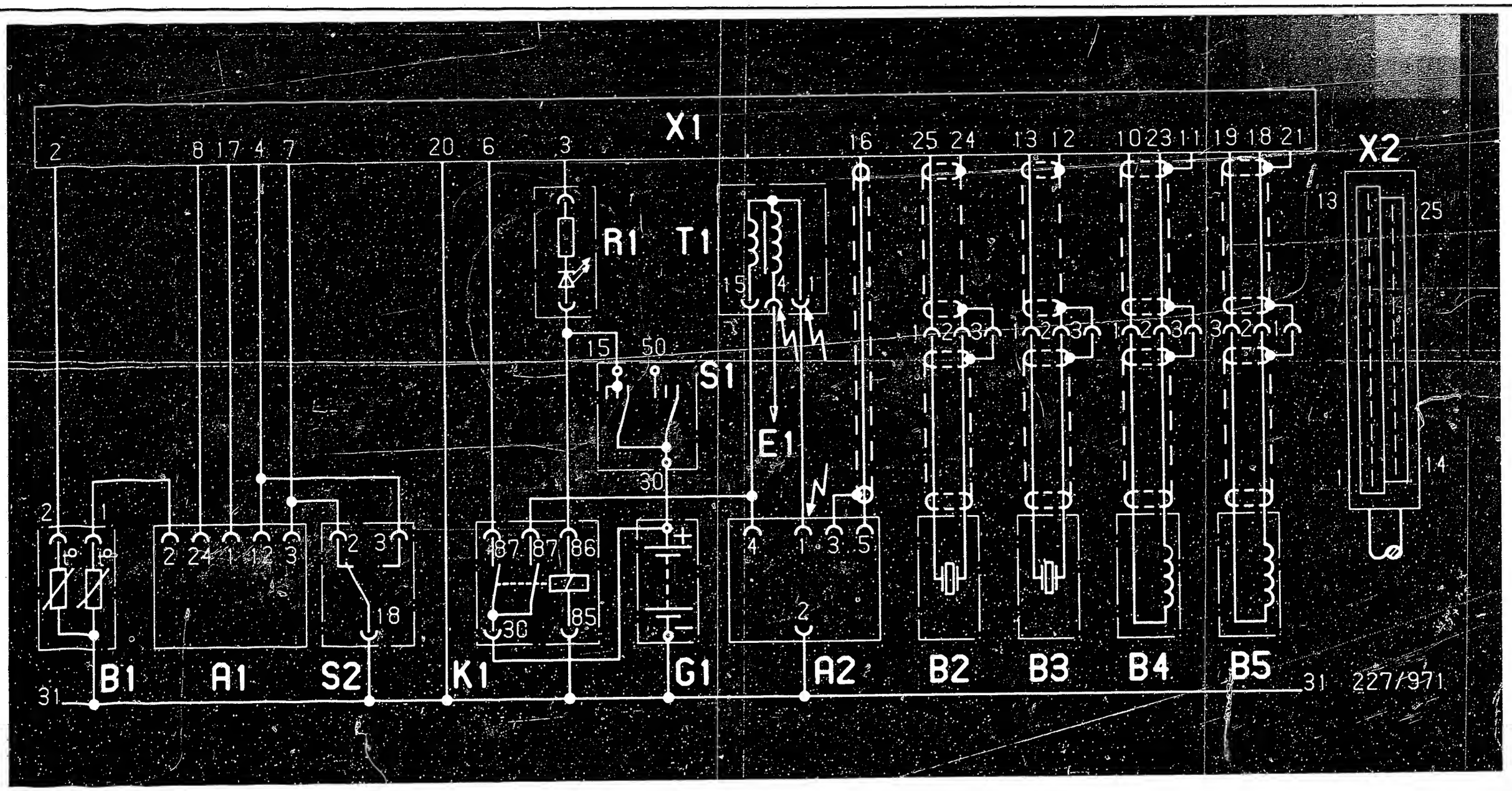


TEST SPECIFICATIONS

Ignition coil, primary		0,6... 1,0 Ω
Ignition coil, secondary		6,4...11,1 k Ω
Coolant-temperature sensor		
Resistance at coolant temp-erature	20° C	2,1...2,9 k Ω
	30° C	1,4...2,0 k Ω
	80° C	280...370 Ω
	90° C	210...280 Ω
	100° C	160...210 Ω
Spark-advance angle at idle with		
EI-K control unit...121		9...13° BTDC
EI-K control-unit...120		15...19° BTDC
Power supply Trigger box with enging idling		12...14 V
Power supply EI-K control unit with engine idling		12...14 V
Power supply Ignition coil with engine idling		min. 10 V
Primary voltage with engine idling		290...370 V
Engine-speed sensor		
Insulation		> 1 M Ω
Internal resistance		445...790 Ω
Voltage		U_{pp} > 2,5 V
Knock-sensor breakaway torque		15...25 Nm
Pulse generator		
Cyl.-1 recognition		approx. 0 Ω

For settings for exhaust gas etc., see LH-Jetronic microcard

For production reasons: continued on the following coordinate.

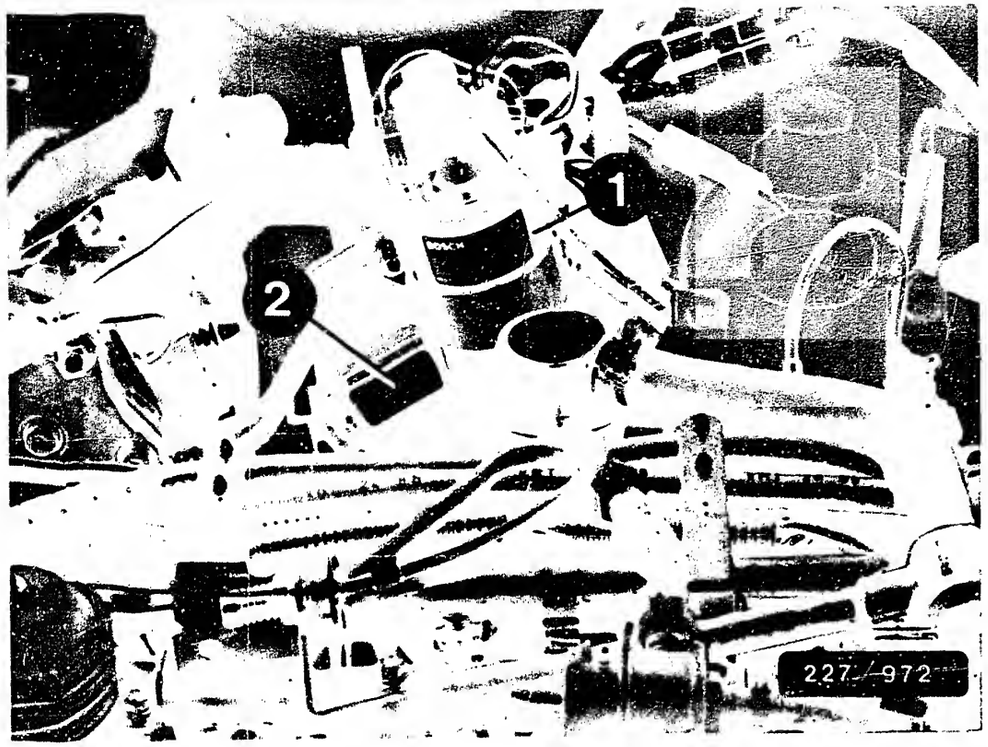


Danger arrows = dangerous voltages (400 V – 25 kV)

A1 = LH-Jetronic control unit
A2 = Trigger box
B1 = Temperature sensor, coolant
B2 = Knock sensor 2 (cylinders 4-5-6)
B3 = Knock sensor 1 (cylinders 1-2-3)
B4 = Engine-speed sensor
B5 = Induction pickup, cylinder 1
E1 = to high-voltage distributor
G1 = Battery
K1 = Power-supply relay
R1 = Fault lamp with protective resistor
S1 = Ignition and starting switch
S2 = Throttle-valve switch
T1 = Ignition coil
X1 = EI-K control-unit plug
X2 = EI-K control unit 1

ELECTRICAL TERMINAL DIAGRAM

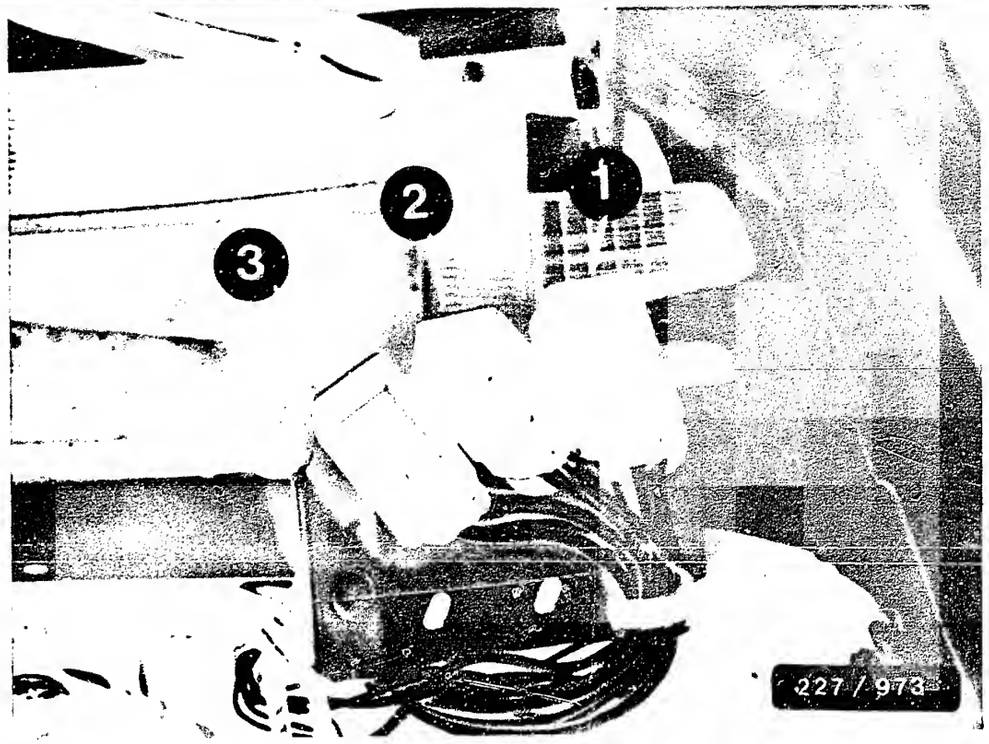
E15 —⟹
E16 ⟸—



1 = Ignition coil
2 = Trigger box with heat sink

INSTALLATION POSITION OF COMPONENTS

The trigger box and the ignition coil are mounted on a common heat sink and are accommodated in the engine compartment on the left-hand side as viewed in the forward direction of travel.



1 = Ignition power-supply relay
2 = LH-Jetronic main relay
3 = Fuel-pump relay

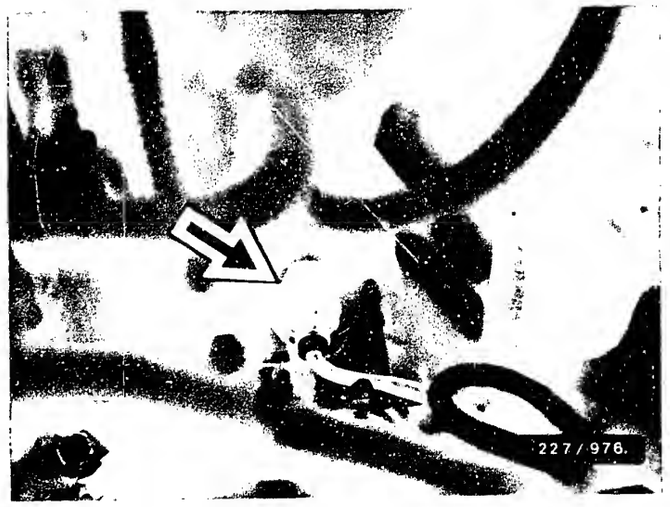
INSTALLATION POSITION OF COMPONENTS (continued)

INSTALLATION POSITION OF COMPONENTS (continued)

The pulse generator for cylinder–1 detection is slipped onto the ignition cable of cylinder 1, see arrow in top picture.

The coolant–temperature sensor is on the engine at the front, on the thermostat housing, see arrow in center picture.

The engine–speed sensor is on the engine at the rear, on the clutch housing, see arrow in bottom picture.

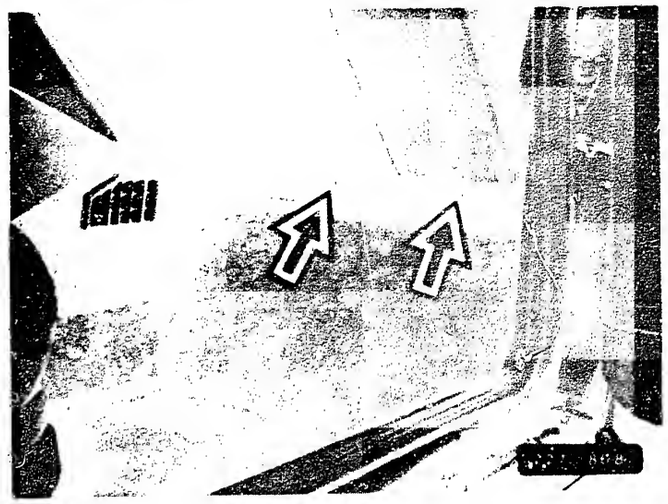


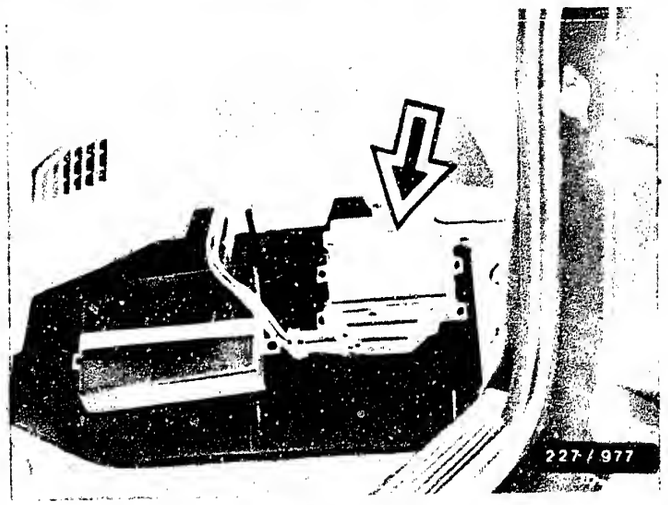
INSTALLATION POSITION OF COMPONENTS (continued)

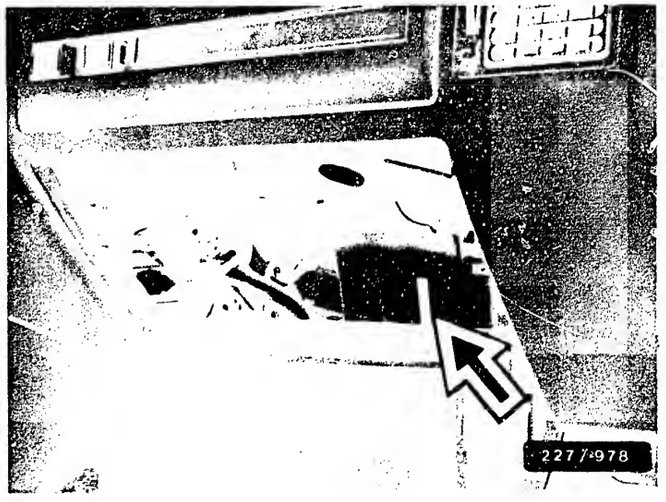
The EZ-K control unit is in the front-passenger footwell under a floor plate, see arrow in center picture.

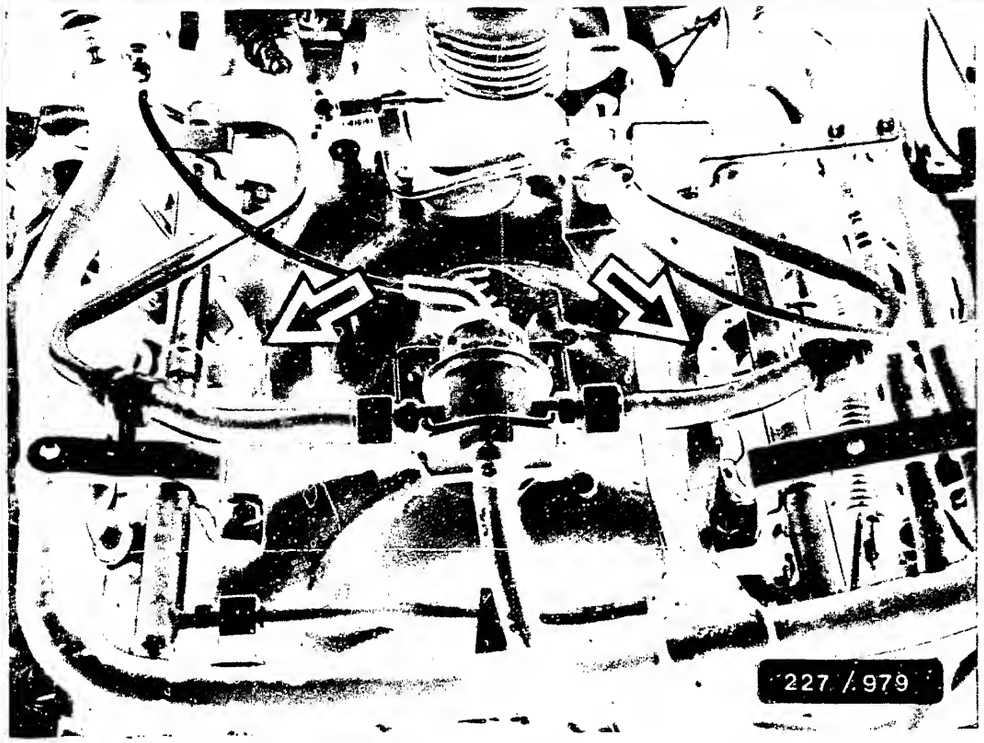
How to remove:
Loosen two nuts on the upper edge of the floor plate and take off floor plate, see arrows in top picture.

The LH-Jetronic control unit is behind the glove box, see arrow in bottom picture.









Arrows = knock-sensor plug-in connections

The knock sensors are under the intake manifold on the engine block (not visible in picture).

How to remove:
Remove fuel lines, electric leads, injection valves and intake manifold.

Mount fastening screw of knock sensor
w i t h o u t washer, spring lock washer, tooth lock washer etc.

Tightening torque 15 ... 25 Nm

Lock fastening screw with locking paint only.

For production reasons:
continued on the following coordinate.

INSTALLATION POSITION OF COMPONENTS (continued)

Fault Lamp (1) including protective resistor are in the instrument panel (top picture).

How to remove:

Remove steering wheel (wheels straight ahead).

Introduce thin screwdriver consecutively into the two holes in the instrument panel (top picture, arrows).

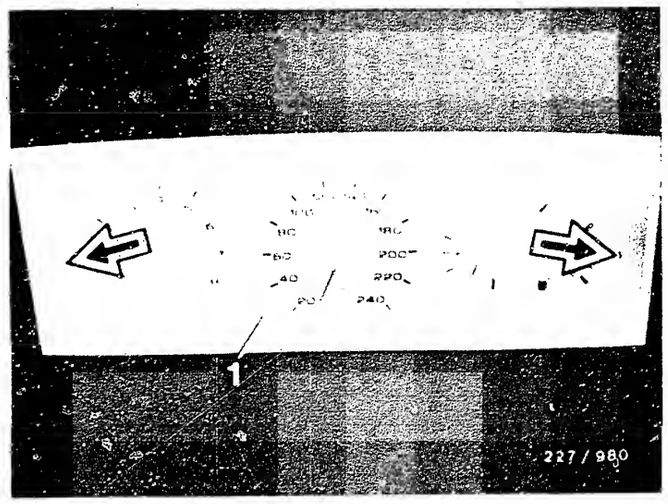
Instrument panel is unlatched by pressing lightly on the screwdrivers.

Pull instrument panel out of installation opening (speedometer shaft has latching connection).

Remove socket of fault lamp (1) (see bottom picture).

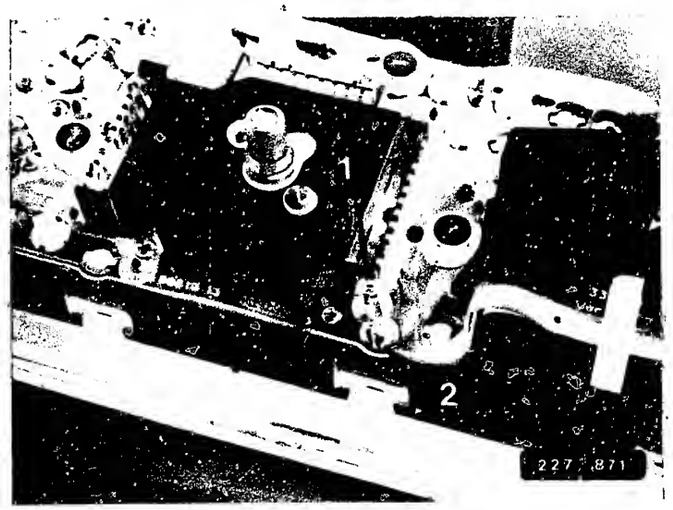
Installation of fault lamp:

Marked by a large recess on the lower part of the printed-circuit board for leading through the protective resistor (2) (see bottom picture).



1 = Fault lamp

1 = Socket of fault lamp
2 = Protective resistor



Trouble-shooting instructions	:	BMW5004
BOSCH system	:	Motronic M 1.1
Make of vehicle	:	BMW
Basic microcard	:	PKW-052

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Test specifications	15
Electrical terminal diagram	19
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SPECIAL FEATURES

These trouble-shooting instructions apply to the following vehicle models, valid at the time of compilation:

* BMW 735i with 3.5 l / 6 cyl. as of 10.86
  BMW 730i with 3.0 l / 6 cyl. as of 1.87

*Motronic M 1.1 system with self-diagnosis and flash-code output.

*Control unit with variant coding.
Important! When ordering, take note of detailed description (see below).

*Control unit has 55-pin plug.

*Common sensor for engine speed and reference mark.

*Grouped fuel injection: subdivision into 2 groups with time-staggered injection.
Group 1: cylinders 1,3,5.
Group 2: cylinders 2,4,6.
Identification via sensor on h.v. cable, cylinder 6.

*Lambda closed-loop control and tank ventilation with cycled valve (if fitted).

STRUCTURE, USAGE

These brief instructions essentially comprise vehicle-specific special features and test specifications (set values).
The trouble-shooting chart guides you to various causes/component faults in accordance with the customer complaint.
Detailed instructions on trouble-shooting are to be taken from the basic instructions, via the trouble-shooting chart.

NOTE: Even if reference is made to basic instructions, the set values, terminal assignments and special features of <u>these</u> vehicle-related brief instructions are <u>always</u> binding.

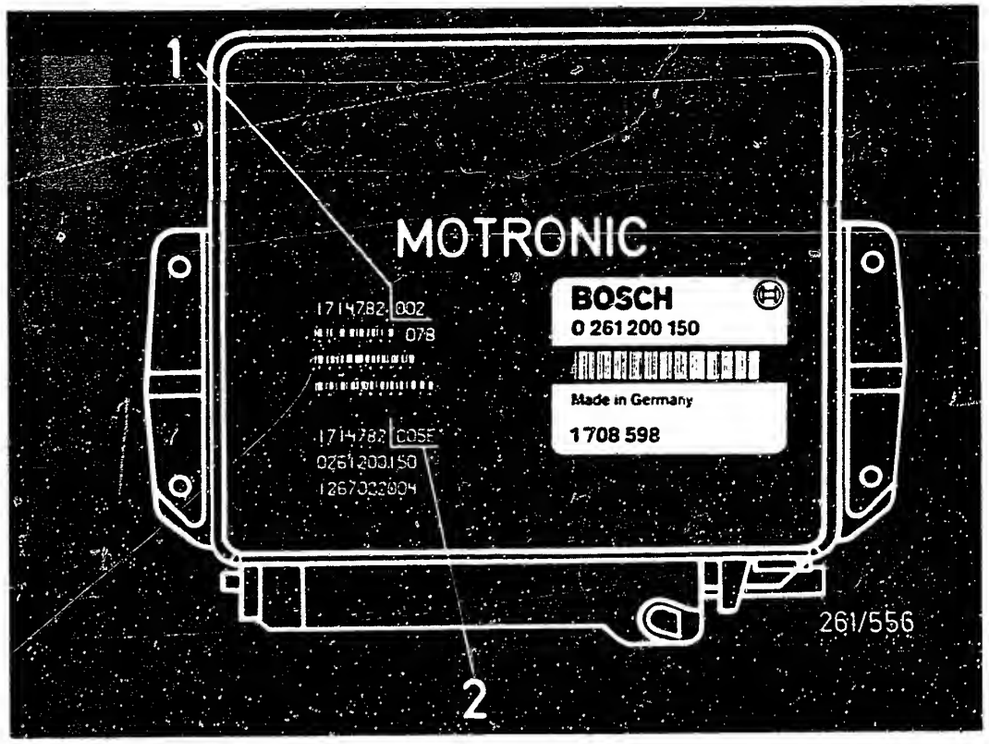
Holding circuit for tank vent valve.

As of 12.86, Motronic control units are fitted with a holding circuit for the tank vent valve in the 735i. The holding circuit is always installed, without being allocated to vehicles with or without catalytic converter.
The holding circuit has the effect that the main relay remains pulled in for approx. 3 seconds after stopping the engine. In this way, the tank vent valve is closed via the control unit, preventing the engine from running on.

BMW initially introduced a new wiring harness with an additional adapter to implement the holding circuit.
The additional adapter (BMW No.1 718 200) provides the necessary connections to the control unit, main relay and term.15. As of 1.87, the holding circuit is integrated in the wiring harness, i.e. the additional adapter is dropped.

Operation of Motronic control units up to FD 651 with the new wiring harness is possible by removing the additional adapter and interconnecting plugs B and C. Plug A remains open.
Plug A = 2-pin to control unit terms.27 and 36
Plug B = 3-pin pin housing
Plug C = 3-pin socket housing

Motronic conrol units as of FD 652 with the holding function can be operated on the wiring harness without the additional adapter by establishing a connection between control unit term.27 and ignition coil term.15 (see terminal diagrams). However, the holding function is not activated.
Note: fit revised coding plug in instrument cluster.



Control unit 0 261 200 150, old version FD 645 to 651.

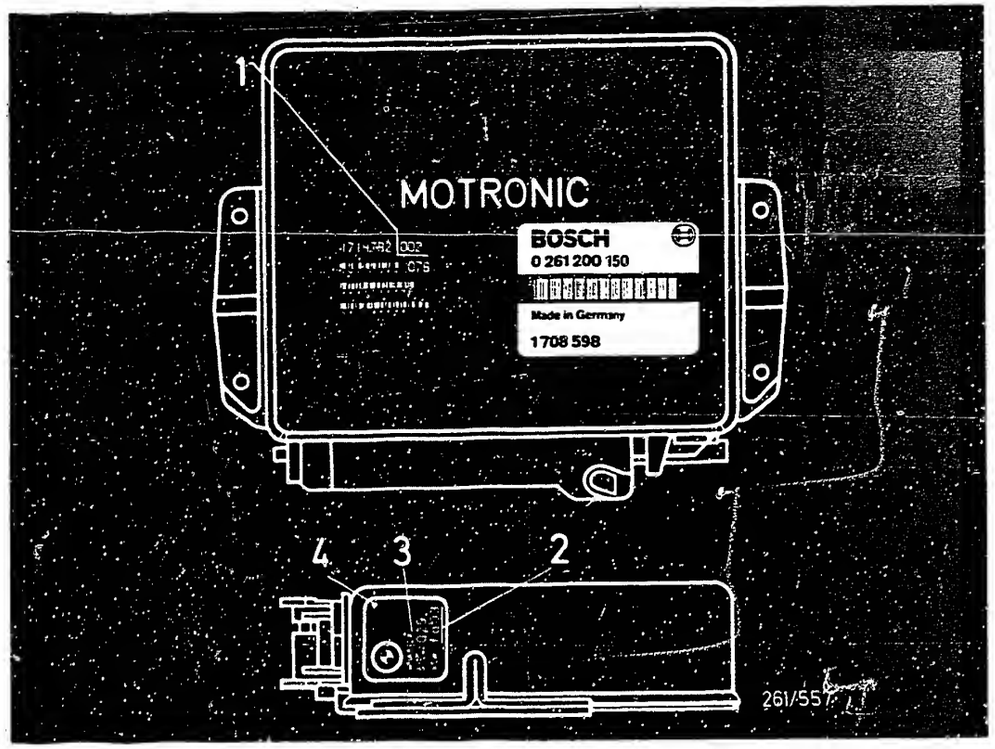
1 = Growth number, 3-digit
2 = Variant control word, 4-position, alphanumeric

<u>Variant-coded Motronic control units</u>

When the new BMW 7 Series was introduced as of 10.86, a new type of control unit also entered series production.

The desired variant must be activated in a basic control unit in order to be able to adapt the engines to various types of transmission, to the model series, to different national versions and to differing fuel qualities and other special versions.

The object of this is to reduce the number of types of control unit.



Control units, new version as of FD 652

1 = Growth number, 3-digit
2 = Variant control word, 4-position,
    alphanumeric
3 = Chassis number
4 = BMW sticker

The new control-unit type must be programmed for the specific vehicle type b e f o r e delivery to the BG/BD at KH.

Note: the engine will not run with uncoded control units. Damage to the engine may occur with incorrectly coded control units.

Coding and programming can be carried out at KH only.
To do this, KH requires the 10-digit part number for the basic control unit plus further information which is to be taken from the installed control unit.

The following information must be given when ordering:

1. Part number, 10-digit as before
2. Growth number, 3-digit (001 to 999)
3. Variant control word, 4-position, alphanumeric.

Example: 1. 0 261 200 150
         2. 002
         3. C05E

Delivery procedure:

+The variant-coded control units are carried at KH as central stock parts.

+Delivery by overnight despatch (within the Federal Republic of Germany) directly to the orderer.

+Delivery is extended by one day due to the necessary programming of the control units at KH.

SAFETY AND PRECAUTIONARY MEASURES

Keep people away from danger.
Avoid damage to engine, control unit and ignition system.

* W A R N I N G !
  High energy ignition system.
  Dangerous high and low voltages.

  Do not touch live parts or terminals.
  Danger from primary and secondary circuits. This applies to e.g. control unit, high-voltage distributor, at the ignition coil.

* Avoid injection and high-voltage flashovers during the compression test. For this reason, pull out main relay. ||

See basic instructions for further precautionary measures.

|| = System-specific

TROUBLE-SHOOTING CHART

Customer complaints (symptoms of trouble)

1. Starting motor operates, engine fails to start or starts only with difficulty.	2. Engine starts but but then dies.	3. Rough idling (engine speed, exhaust gas).	4. Poor throttle response, flat spot during acceleration.	5. Engine misfiring (ignition, fuel injection).	6. Maximum engine power/ top speed not reached.	7. Fuel consumption too high.	8. Engine running on (dieseling).	9. Engine pinging/knocking.	10. Engine overheating.	11. Fault lamp.	Cause (component fault)
*	*	*	*	*	*	*	*	*	*		Self-diagnosis
*											Voltage at control unit
*											Engine-speed/reference mark sensor
*		*			*	*					Fuel pressure
*		*				*	*				Solenoid-operated injection valves
		*	*		*						Throttle-valve switch
	*	*	*	*	*	*					Air-flow sensor
	*	*	*								Idle actuator
*	*	*	*								Air-intake system
		*									Idle speed, CO
*		*		*	*						Ignition coil
*		*	*	*	*						Primary signal
		*	*	*	*	*					Secondary pattern
*	*	*	*		*	*		*	*		Ignition point
*				*							High-voltage sensor
		*									Overrun cut-off
		*	*	*							Interference-suppression resistors
		*	*	*							Noise test
					*						Interference
					*						Throttle valve
					*						Fuel delivery
	*	*	*				*				Tank vent
		*	*								Lambda closed-loop control
*	*	*	*	*	*	*	*	*	*		Control unit

SELF-DIAGNOSIS TEST TABLE

Fault indication Flashing code	Testing of component/function	Test instructions/ Test conditions	Term-inals	Set values
1 2 1 1	Control unit (memory contents)	Control unit defective.		———
1 2 1 5	Air-flow sensor	Check lead to term. 7 for open circuit, short circuit to ground or to positive (5V or batt. +ve) and for contact with term. 12 and term. 26. Check leads to term. 12 and term. 26 for open circuit. Check resistors of air-flow sensor: between term.26 and term.7 (def. air-fl. sens. flap): between term. 26 and term. 12:	7,12,26	——— 8...2500 Ω 500...1100 Ω
1 2 2 1	Lambda sensor	Lead to lambda sensor open-circuited, short-circuited to ground or battery voltage. Watch for damage to cable insulation. Sensor heater defective. Sensor clogged.	28	———
1 2 2 2	Lambda closed-loop control to rich or lean stop	Check CO content: Check induction system for leaks. Check fuel pressure: Injection valves defective.		0,5...1,5 % by vol.
1 2 2 3	Coolant-temperature sensor	Check temperature sensor and lead for open circuit and short circuit to ground. Temperature-sensor resistance: at +15...+30°C : at approx. +80°C :	45	——— 0,2...1,2 Ω 2,8...3,2 Ω

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Fault indication Flashing code	Testing of component/function	Test instructions / Test conditions	Terminals	Set values
1 2 2 4	Air-intake temperature sensor	Check temperature sensor and lead for open circuit and short circuit to ground. Temperature-sensor resistance at +15° C... +30°C:	44	——— 1450...3300 Ω
1 2 3 1	Supply voltage for control unit with engine running	Supply voltage too low: Check voltage drops at positive and ground terminals. Charge battery. Supply voltage too high : Check alternator regulator.	37(+), 19(−)	Greater than 10 V Less than 16 V
1 2 3 2	Throttle-valve switch/ idle contact	Fault: idle contact constantly closed. Idle contact closed in inoperated position: Slightly actuate throttle valve :	52	 0 Ω Infinity Ω
1 2 3 3	Throttle-valve switch/ full-load contact	Fault: full-load contact constantly closed. Full-load contact closed in full-throttle position: Ease off accelerator pedal slightly.	53	 0 Ω Infinity Ω
1 2 5 1	Injection valves 1+3+5 and control unit (injection output stage)	Fault: short circuit to ground, to batt. +ve or open circuit in common positive or negative lead. Check lead and valves 1+3+5 for short circuit and open circuit; if O.K., control unit defective.	16	4,8...5,7 Ω (3 valves in parallel) 14,5...17 Ω (1 injection valve)

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Fault indication Flashing code	Testing of component/function	Test instructions / Test conditions	Terminals	Set values
1 2 5 2	Injection valves 2+4+6 and control unit (injection output stage)	Fault: short circuit to ground, to batt. +ve or open circuit in common positive or negative lead. Check lead and valves 2+4+6 for short circuit and open circuit; if O.K., control unit defective.	17	4,8...5,7 Ω (3 valves in parallel) 14,5...17 Ω (1 injection valve)
1 2 6 2	Idle actuator and control unit (output stage)	Fault: short circuit to ground or to batt. +ve. Check leads for contact with ground or batt. +ve; if O.K., control unit defective. Winding resistances at +15...+30°C: between terminal 1 and 2 : between terminal 3 und 4 :	4, 22	19...25 Ω 17...22,5 Ω
1 2 6 3	Tank-ventilation valve and control unit (output stage) Note: CAT models only	Fault: short circuit to ground or to batt. +ve. Check lead for contact with ground or batt. +ve; if O.K., control unit defective. Winding resistance at +15...+30°C:	5	35...55 Ω
1 2 7 8 *	Transmission action	Fault: short circuit to ground. Check lead for short circuit to ground, or corresponding output in transmission control unit defective.	51	———
1 2 8 8	Fault lamp and control unit (lamp output stage)	Fault: short circuit to ground or to batt. +ve.	15	

* = Applies to vehicles with electronic transmission control

Pressure regulator	
Fuel pressure	2,8...3,2 bar
Electric fuel pump	
Delivery (measured in return)	at least 950 cm^3 /30s
Supply voltage (under load):	at least 12 V
Air-intake temperature sensor	
Internal electrical resistance measured in air-flow sensor between term. 1 and term. 4 at ambient temperature (+15°C...+30°C):	1450...3300 Ω
Coolant-temperature sensor	
Color of plug, blue. Internal electrical resistance at ambient temperature (+ 15° C...+ 30° C):	1450...3300 Ω
with engine at normal operating temperature (approx. +80°C):	280...360 Ω
Solenoid-operated injection valve	
Internal electrical resistance at ambient temperature (+ 15° C...+ 30° C):	14,5...17 Ω
Air-flow sensor	
Internal electrical resistance between:	
term. 2 and term. 4:	8...2500 Ω (*)
term. 3 and term. 4:	500...1100 Ω

(*) Slowly deflect the air-flow sensor flap as far as it will go. Resistance fluctuates between the terminal points of the potentiometer.

Engine-speed and reference-mark sensor	
Internal electrical resistance between term. 1 and term. 2 at ambient temperature (+15°C...+30°C):	400...800 Ω
Air gap:	0,8±0,5 mm
Throttle-valve switch	
Resistance value of idle contact (term. 2 and term. 18):	0 Ω
Resistance value of full-load contact (term. 3 and term. 18):	0 Ω
Idle actuator	
Internal electrical resistance at +15°...+30°C between	
term. 1 and term. 2:	19...25 Ω
term. 3 and term. 2:	17...22,5 Ω
Lambda sensor	
Resistance value of heater winding:	1...15 Ω
Ignition coil	
Primary resistance: approx.	0 Ω
Secondary resistance:	5000...7200 Ω
Interference-suppression resistors	
High-voltage-distributor rotor:	1 k Ω
High-voltage-distributor dome: each	1 k Ω
Spark-plug connector: each	5 k Ω
Spark plugs:	5 k Ω
Ignition coil:	1 k Ω

TEST SPECIFICATIONS (CONTINUED)

High-voltage sensor:
Internal electrical resistance
between term. 1 and term. 2: approx. 0 Ω

Tank-ventilation valve:
(only in vehicles with catalytic converter)
Internal electrical resistance at
ambient temperature (+15°C...+30°C): 35...55 Ω

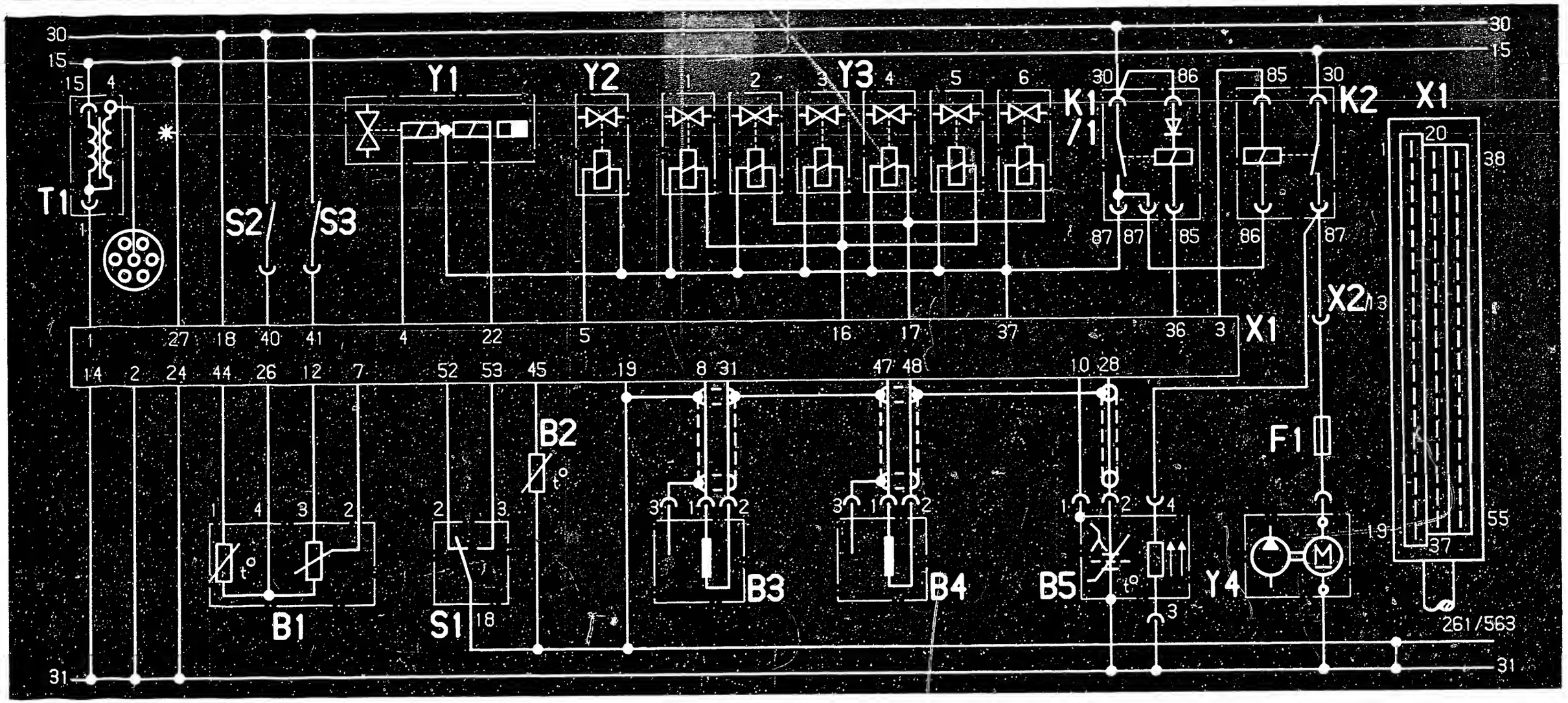
Idle test:
Engine at normal operating temperature,
switch off loads.
Idle speed: 800±40 min $^{-1}$
Spark-advance angle: 10±5°
crankshaft
(Automatic transmission to N or P)

CO content: without catalytic converter: 0,5...1,5 % CO by vol.
Adjust mixture at the bypass screw
in the air-flow sensor:
turning to the left makes mixture leaner,
turning to the right makes mixture richer.

Vehicles with catalytic converter: 0,2...1,2 % CO by vol.
(measure CO upstream of the catalytic converter if sampling pick-up fitted, pull apart lambda-sensor plug).

For production reasons:
continued on the following
coordinate.

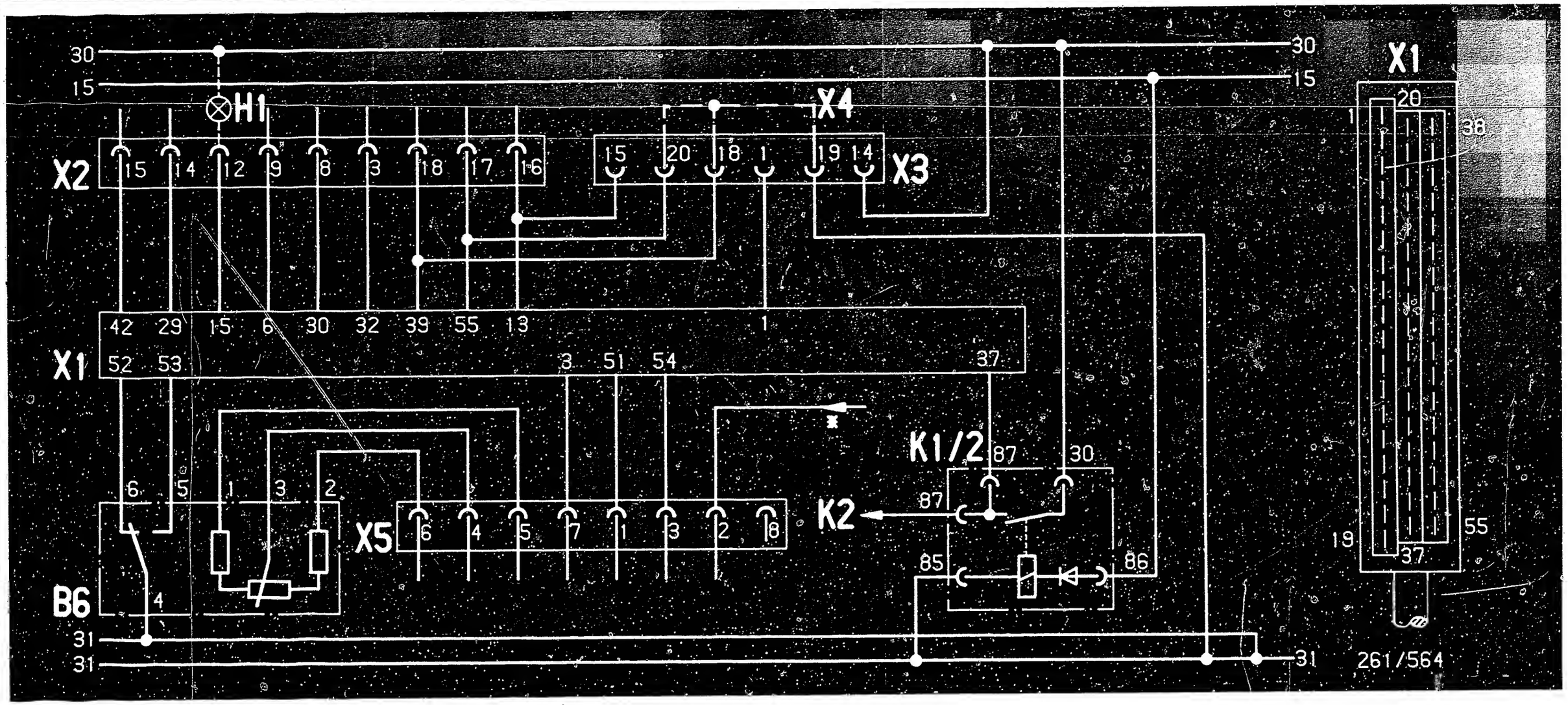
See equipment and Autodata microcards for the settings for valve clearance and other engine-related data.



B1 = Air-flow sensor
B2 = Engine-temperature sensor
B3 = High-voltage sensor
B4 = Engine-speed/reference-mark sensor
B5 = Heated lambda sensor (Cat only)
F1 = Pump fuse
K1/1 = Main relay (circuitry as of 12.86)
K2 = Pump relay
S1 = Throttle-valve switch
S2 = Switch on air-conditioner compressor
S3 = Switch on air conditioner
T1 = Ignition coil
X1 = Motronic control-unit plug
Y1 = Idle actuator
Y2 = Tank-ventilation valve (Cat only)
Y3 = Solenoid-operated injection valve
Y4 = Electric fuel pump

*) = Lead as of FD 652

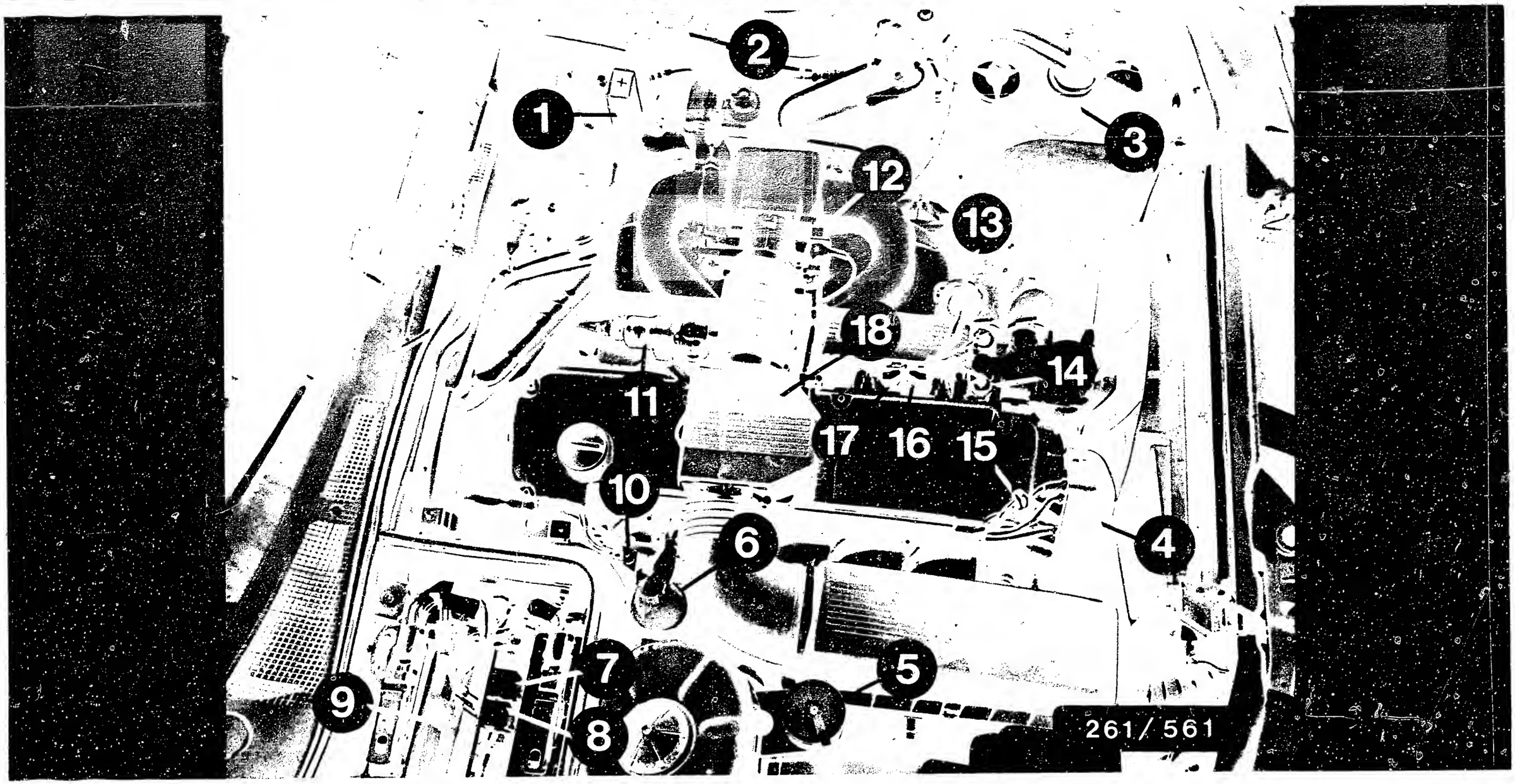
ELECTRICAL TERMINAL DIAGRAM



ELECTRICAL TERMINAL DIAGRAM (1)

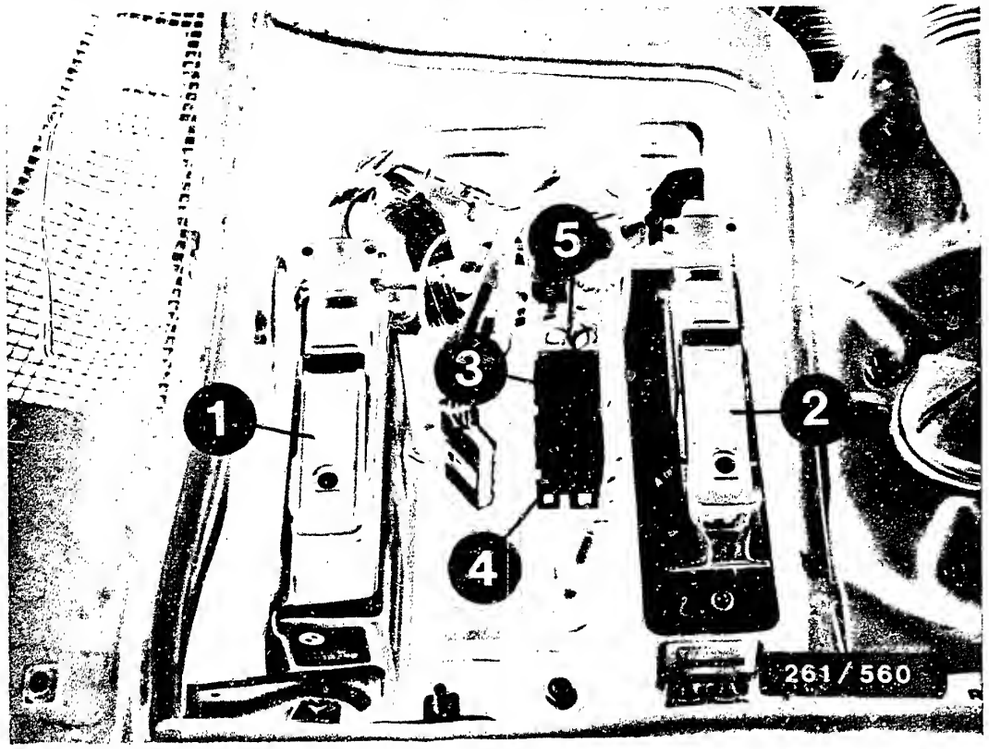
B6 = Throttle-valve switch with potentiometer (with electronic trans. control instead of Item S1)
H1 = "CARB" lamp (indicator lamp; US version)
K1/2 = Main relay (circuit up to 12.86)
K2 = Pump relay
* = From main relay term. 87 (+)

X1 = Motronic control-unit plug
X2 = Engine plug (20-pin)
X3 = Diagnostic plug (20-pin)
X4 = Bridge in diagnostic-plug cover
X5 = 8-pin plug to transmission control unit



INSTALLATION POSITION OF COMPONENTS

1 = Positive battery terminal
2 = Engine plug
3 = Active-carbon container (cat. only)
4 = High-tension distributor
5 = Diagnosis socket
6 = Ignition coil
7 = Main relay
8 = Pump relay
9 = Motronic control unit
10 = Motronic ground terminal
11 = Idle actuator
12 = Throttle-valve switch
13 = Fuel-pressure regulator
14 = Engine-temperature sensor
15 = High-tension sensor (cyl. 6)
16 = Plug, high-tension sensor
17 = Plug, speed/ref. mark sensor
18 = Air-flow sensor



1 = Motronic control unit
2 = ABS control unit
3 = Main relay
4 = Pump relay
5 = Plug connection, if transmission control fitted

INSTALLATION POSITION OF COMPONENTS (1)

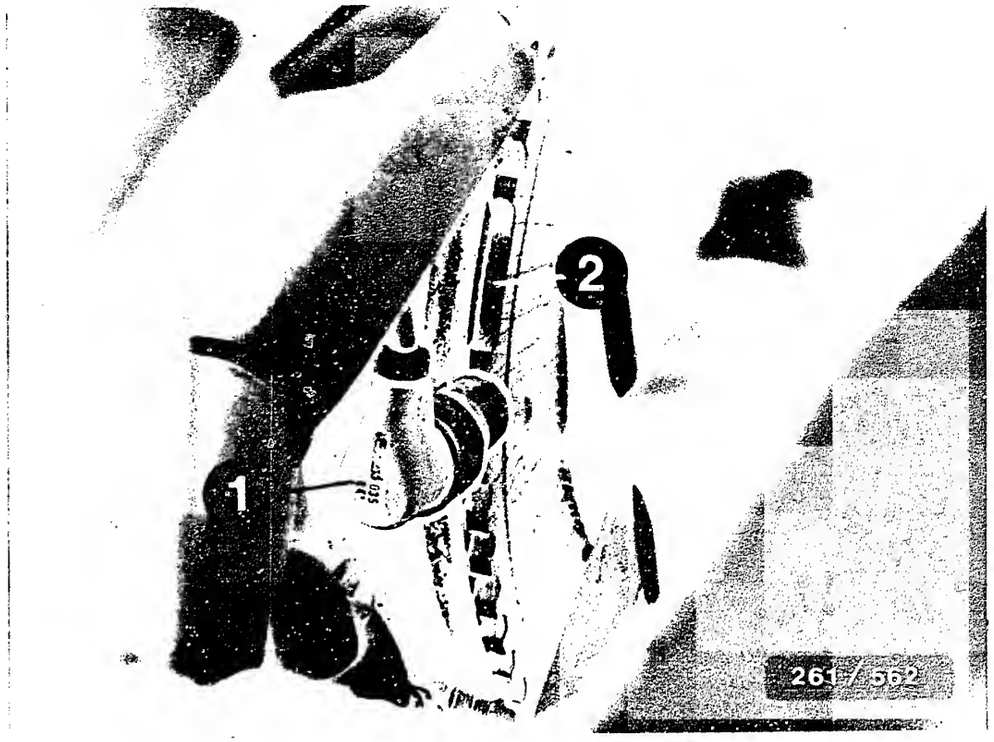
The installation position given is always as viewed from behind the vehicle.

Control unit:
In the instrument compartment beneath the hood (E box on the right-hand firewall). Unscrew cap.

Main relay:
In the instrument compartment. White relay housing.

Pump relay:
In the instrument compartment. Orange relay housing.

Air-temperature sensor:
In the air-flow sensor.



1 = Engine-speed/reference-mark sensor
2 = Ring gear with gap

Electric fuel pump:
In the fuel tank.

Fuel filter:
Beneath the vehicle, in front of the fuel tank on the right.

Reference-mark/engine-speed sensor:
At front of engine, to the right of the crankshaft ring gear.
Plug connection between the injection valves of cylinders 1 and 2 (left-hand plug connection).

Ground terminal:
Next to the instrument compartment on the left, beneath a cap, close to the igniton coil.

INSTALLATION POSITION OF COMPONENTS (3)

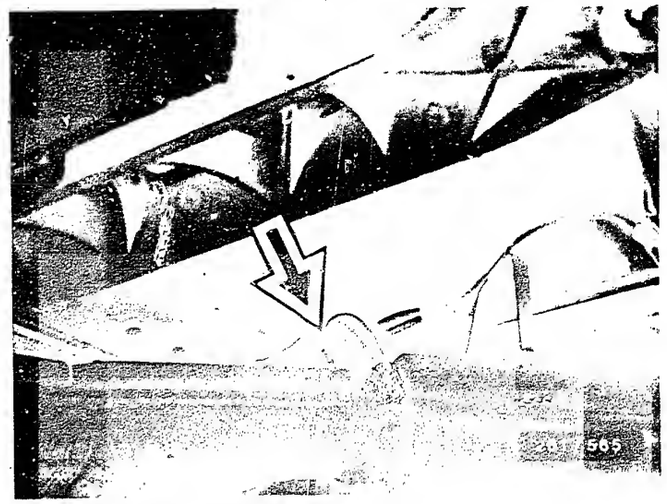
Lambda sensor:
In the common exhaust pipe (arrow, top picture). Round plug connection, 4-pin beneath the starting motor (arrow, center picture).

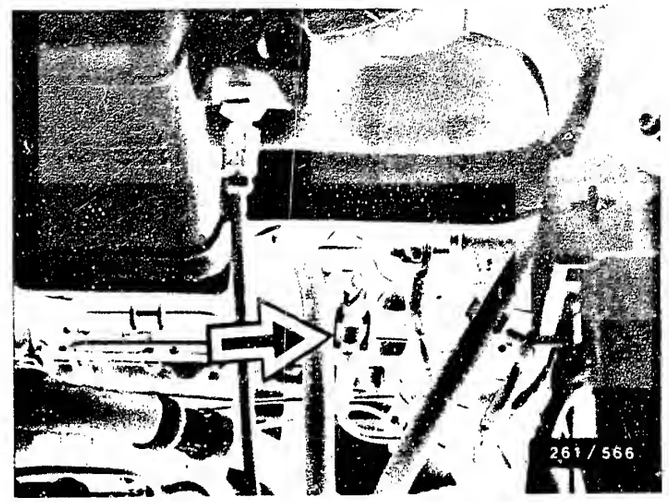
Tank vent valve:
Mounted on intake manifold in engine compartment, close to oil dipstick (arrow, bottom picture).

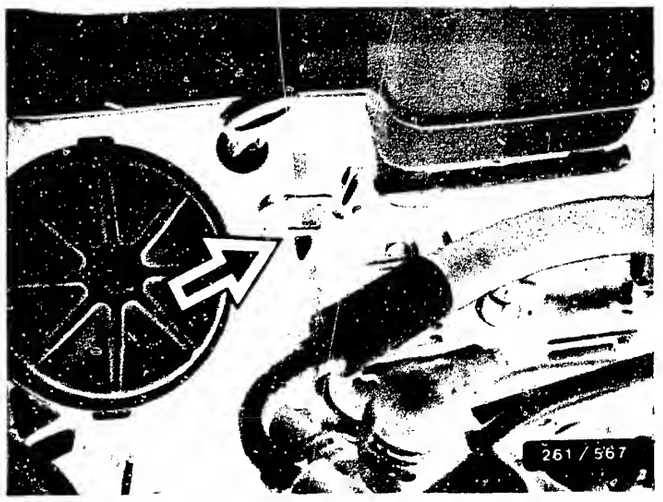
Fuse no. 23 for electric fuel pump:
In the fuse box on the left-hand firewall.

High-tension sensor:
On ignition cable for cylinder 6.
Plug connection between the injection valves of cylinders 1 and 2 (right-hand plug connection).

Battery:
Beneath the rear seat bench.







Trouble-shooting instructions : JAG-5000

BOSCH system : EZ

Make of vehicle : JAGUAR

Basic microcard : PKW-049

TABLE OF CONTENTS

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Special features, safety, usage	A01
Trouble-shooting chart	A05
Rapid diagnosis chart	A07
Test specifications	A13
Electrical terminal diagram	A15
Installation position of components, notes on removal/installation	A17

SPECIAL FEATURES

These trouble-shooting instructions, valid at the time of publication, apply to the following Jaguar model:

XJ 6 with 2.9 l 6-cylinder engine 9.86 ->
EU model without catalytic converter,
A, AUS, CH and J models with catalytic converter.

* Electronic ignition system with load detection via intake-manifold pressure measurement (EI).
* Control unit 0 227 400 011 for EU model without catalytic converter.
* Control unit 0 227 400 015 for A, AUS, CH, J models with catalytic converter.
* The EU model without catalytic converter is additionally equipped with a vacuum switch-over facility; see basic instructions for more detailed instructions.

USAGE, STRUCTURE

These brief instructions essentially encompass vehicle-specific special features and test specifications (set values).

Corresponding to the customer complaint, the trouble-shooting chart leads to different causes/ component faults.
Detailed instructions with regard to trouble-shooting must be taken from the basic instructions via the trouble-shooting chart.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features in t h e s e vehicle-related brief instructions are a l w a y s binding.

SAFETY AND PRECAUTIONARY MEASURES

Keep people out of danger.
Avoid damage to the engine, control unit or ignition system.

* C A U T I O N !
  High-performance ignition system.
  Dangerous high and low voltages.

  Touching live parts or terminals may be dangerous (both on the primary and secondary sides).

* When testing the compression, disconnect EI control-unit plug or f i r m l y apply ignition coil term. 4 to ground using auxiliary cable.

  N o t e :
  Auxiliary cable must be interference-suppressed with at least 2 k Ω .

See Basic Instructions for further precautionary measures.

For production reasons:
continued on the following coordinate.

Customer complaint (symptoms of trouble)

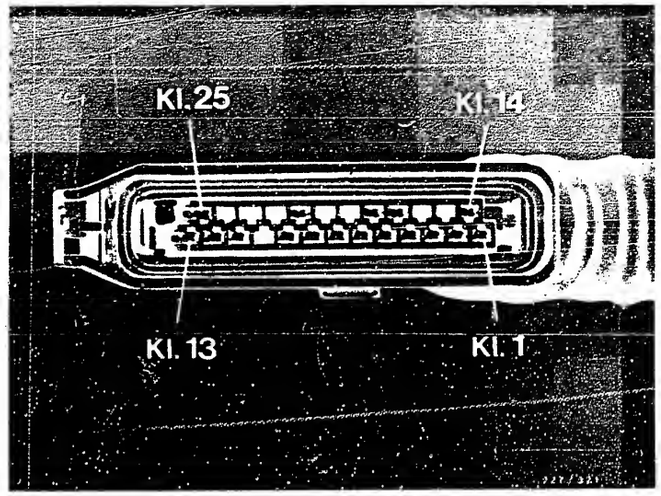
1. Starting motor operates, but engine fails to start or starts only with difficulty.	2. Engine starts but then dies.	3. Rough idling (engine speed, exhaust gas).	4. Poor throttle response.	5. Misfiring (ignition, fuel injection).	6. Maximum engine power/top speed not reached.	7. Fuel consumption too high.	8. Engine diesels.	9. Engine pings/knocks.	10. Engine becomes too hot.	11. Fault lamp.	Cause (component fault)
*		*	*	*	*	*					High-voltage side
*		*	*	*	*						Ignition coil
*		*									Firing sequence
*											Voltage, EI control unit
*											Voltage, primary circuit
			*	*							Engine-speed reference-mark sensor
*											High-voltage distributor
*											Contact resistances
		*	*	*	*	*		*	*		Temperature sensor, coolant

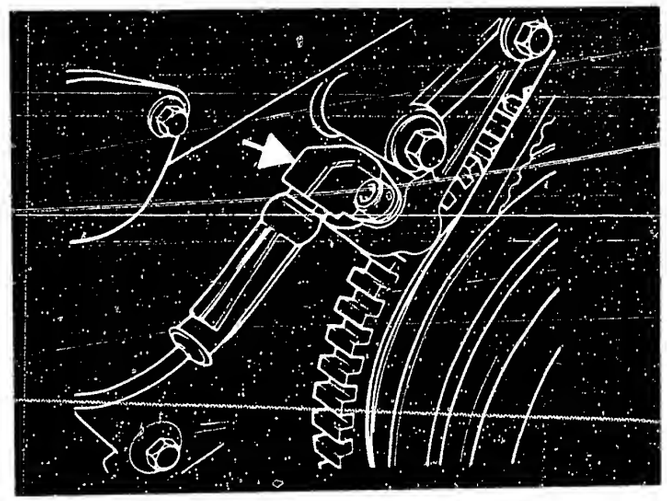
Customer complaint (symptoms of trouble)

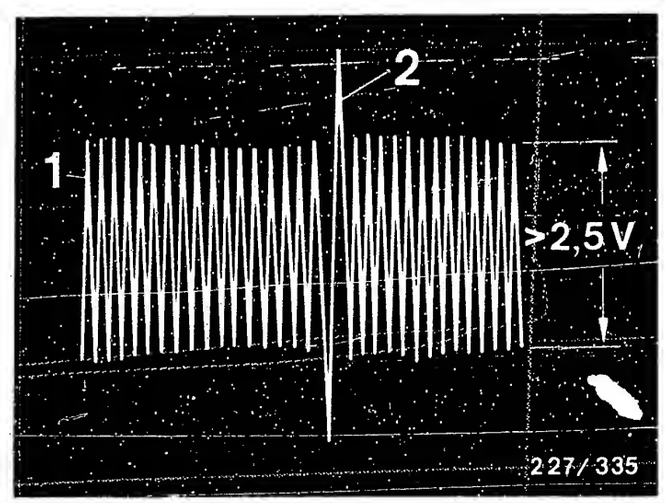
1. Starting motor operates, but engine fails to start or starts only with difficulty.	2. Engine starts but then dies.	3. Rough idling engine speed, exhaust gas	4. Poor throttle response.	5. Misfiring (ignition, fuel injection).	6. Maximum engine power/top speed not reached.	7. Fuel consumption too high.	8. Engine diesels.	9. Engine pings/knocks.	10. Engine becomes too hot.	11. Fault lamp.	Cause (component fault)
	*	*	*	*	*		*	*			Throttle-valve switch, idle
	*	*	*	*	*		*	*			Throttle-valve switch, full load
		*		*	*						Vacuum switch-over
	*	*	*	*	*		*	*			Ignition point
		*			*		*	*			Vacuum sensor
			*								Voltage, EI control unit
			*								Voltage, ignition coil
			*								Primary voltage

RAPID DIAGNOSIS CHART

Test step	Testing of component/function Test conditions/instructions	Terms.	Set values
1	HIGH-VOLTAGE SIDE Visual examination (distributor cap, ignition harness etc). Ignition oscillogram.	———	———
2	IGNITION COIL Visual examination, plug present, sealing compound escaped? Resistance, primary Resistance, secondary	 1 , 15 1 , 4	 0,4...0,7 Ω 5,1...8,6 K Ω
3	VOLTAGE SUPPLY, EI CONTROL UNIT Ignition ON. Voltage, EI control-unit plug	25 , 12 (+) (–)	Approx. U_B
4	PRIMARY CIRCUIT Ignition ON. Voltage, EI control-unit plug	1 , 12 (+) (–)	Approx. U_B
5	ENGINE-SPEED REFERENCE-MARK SENSOR insulation Resistance, EI control-unit plug	7 , 20	> 1 M Ω
	ENGINE-SPEED REFERENCE-MARK SENSOR internal resistance Resistance, EI control-unit plug	7 , 19	0,6...1,6 K Ω
	ENGINE-SPEED REFERENCE-MARK SENSOR function Start engine. Test signal, EI control-unit plug	7 , 19 (+) (–)	For test signal, see lower illustration



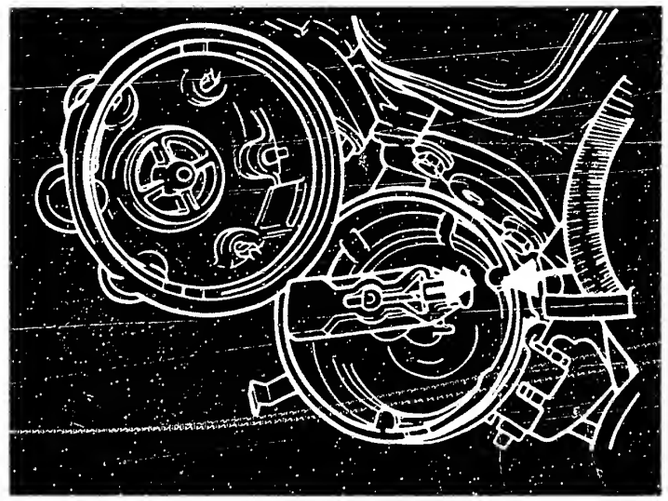


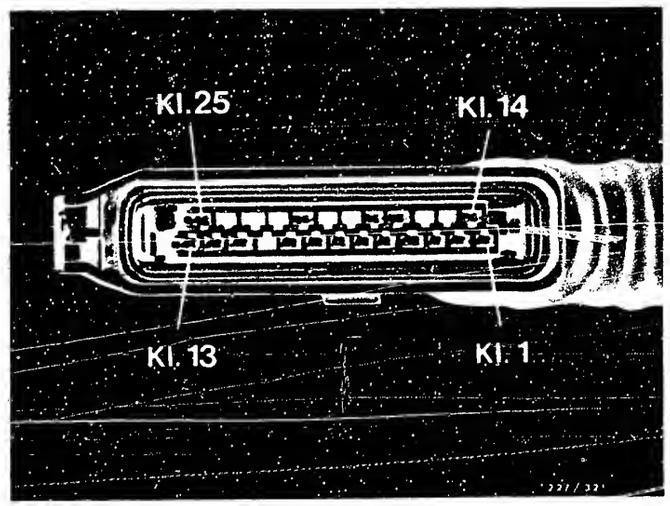


RAPID DIAGNOSIS CHART (continued)

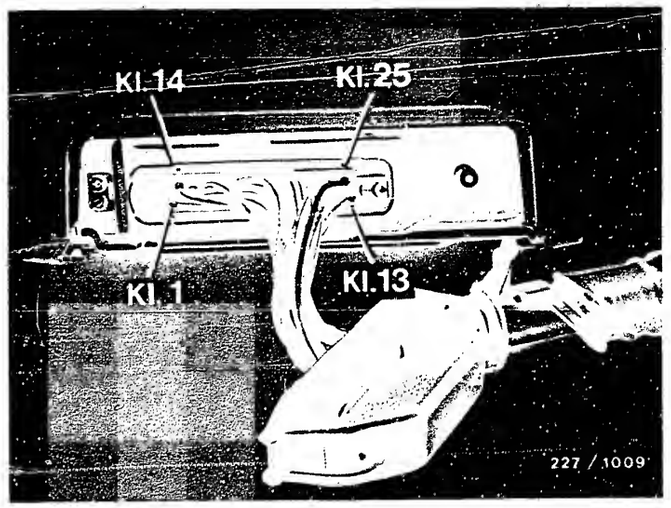
Test step	Testing of component/function Test conditions/instructions	Terms.	Set values
6*	HIGH-VOLTAGE DISTRIBUTOR SETTING Engine cyl. 1 at TDC. Distributor rotor points to housing marking.	———	———
	CONTACT RESISTANCES Check voltage-supply leads from control unit/ primary circuit for contact resistance.		max.0,3 Ω
7	COOLANT TEMPERATURE SENSOR Resistance, EI control-unit plug with temperature at + 20°C + 30°C + 80°C + 90°C + 100°C	23 , 12	2,1...2,9 k Ω 1,4...2,0 k Ω 280...370 Ω 210...280 Ω 160...210 Ω
8	IDLE THROTTLE-VALVE SWITCH Resistance, EI control-unit plug	4 , 12	Approx. 0 Ω
9	FULL-LOAD THROTTLE-VALVE SWITCH Resistance, EI control-unit plug	17 , 12	Approx. 0 Ω
10	VACUUM SWITCH-OVER (EU model without catalytic converter only) Disconnect throttle-valve-switch plug. Run engine at idle, read off spark advance. Disconnect blue-green cable from temperature switch and apply to vehicle ground using auxiliary cable. Read off spark advance.		Spark-advance change

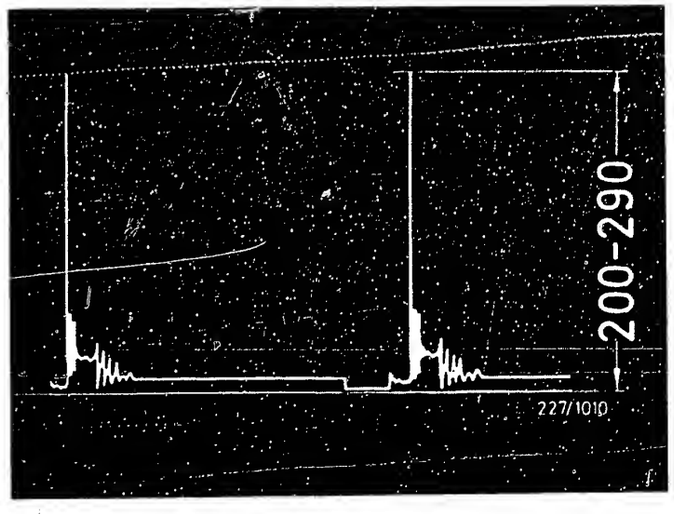
* Perform only when engine is not running.





Test step	Testing of components/function Test conditions/instructions	Terms.	Set values
11	SPARK ADVANCE Engine at normal operating temperature, at idle. Read off spark advance.		5...11° before TDC at 600...700 min $^{-1}$
12	VACUUM SENSOR Engine at normal operating temperature, at idle. Disconnect throttle-valve-switch plug. Disconnect vacuum hose from intake manifold and connect to vacuum pump. Read off spark advance. Build up vacuum of approx. 400 mbar. Read off spark advance.		Spark-advance change, "Advance"
13	VOLTAGE SUPPLY, EI CONTROL UNIT Engine at idle. Voltage, EI control-unit plug with handle grip removed	25 , 12 (+) (-)	12...14 V, max. 1 V below U_B
14	VOLTAGE SUPPLY, IGNITION COIL Engine at idle. Voltage, ignition coil and vehicle ground.	15 , B- (+) (-)	min. 10 V
15	PRIMARY VOLTAGE Voltage, ignition coil with engine at idle.	15 , 1 (+) (-)	200...290 V





TEST SPECIFICATIONS

Ignition coil, primary	0,4...0,7 Ω
Ignition coil, secondary	5,1...8,6 k Ω

Temperature sensor, coolant		
Resistance at coolant temperature	20° C	2,1...2,9 k Ω
	30° C	1,4...2,0 k Ω
	80° C	280...370 Ω
	90° C	210...280 Ω
	100° C	160...210 Ω

Spark advance with engine at idle (600...700 min $^{-1}$)	5...11° before TDC
Voltage supply, control unit with engine at idle	12...14 V

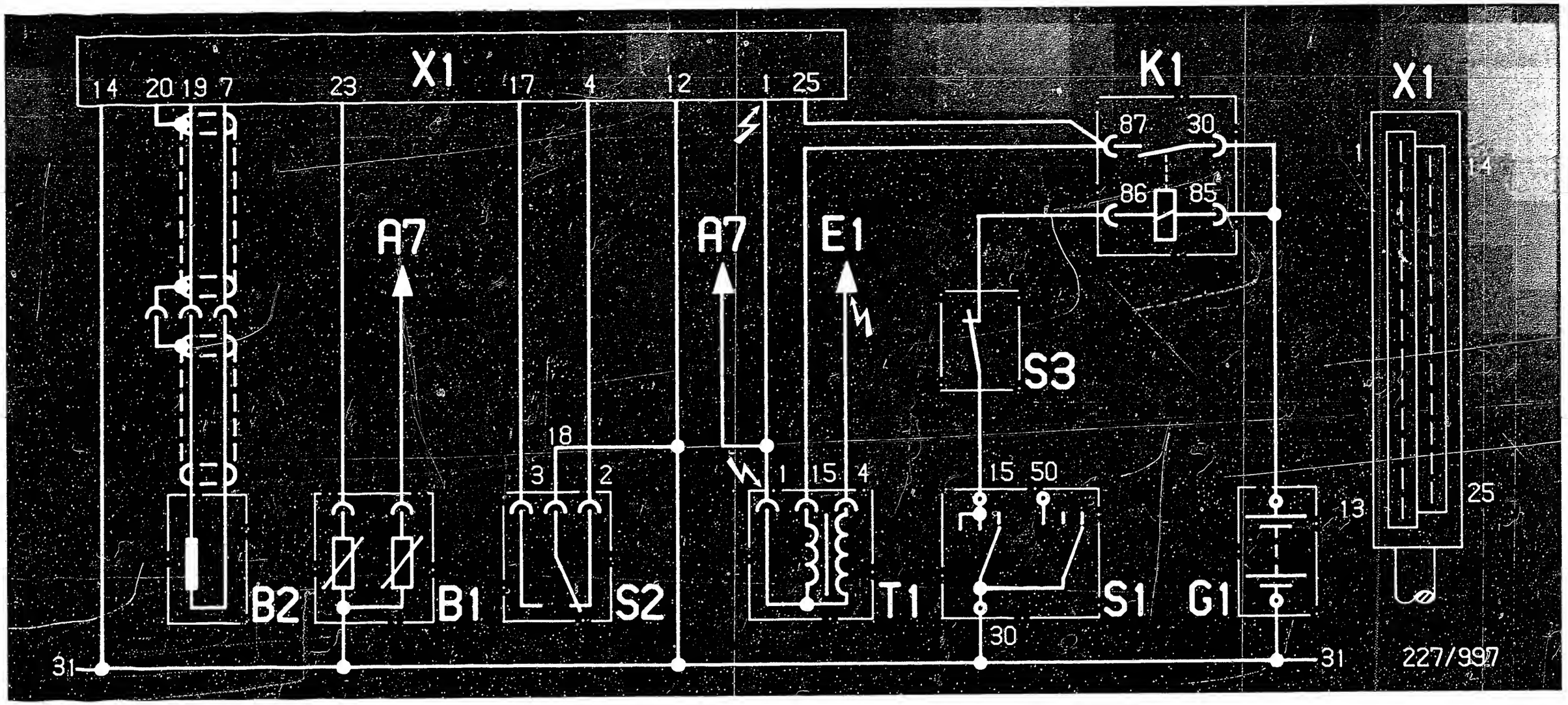
For production reasons: continued on the following coordinate.

Voltage supply, ignition coil with engine at idle	min. 10 V
Primary voltage with engine at idle	200...290 V

Engine-speed reference-mark sensor

Insulation	> 1 M Ω
Internal resistance	0,6...1,6 k Ω
Voltage	U_{pp} > 2,5 V

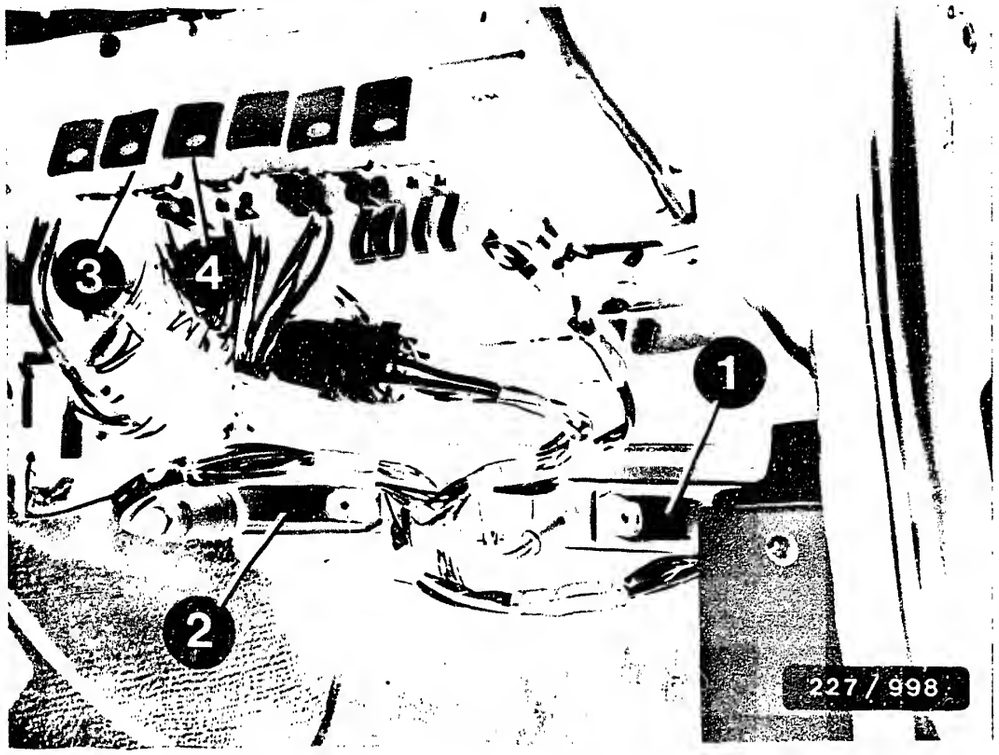
See LH-Jetronic microcard for setting values for exhaust gas etc.



High-voltage symbols: Danger, 400 V...25 kV

A7 = to LH-Jetronic control unit
B1 = Temperature sensor coolant
B2 = Engine-speed reference-mark sensor
E1 = to high-voltage distributor
G1 = Battery
K1 = Supply relay
S1 = Ignition switch (negative-switching)
S2 = Throttle-valve switch
S3 = Impact switch
T1 = Ignition coil
X1 = EI control unit

ELECTRICAL TERMINAL DIAGRAM



INSTALLATION POSITION OF COMPONENTS

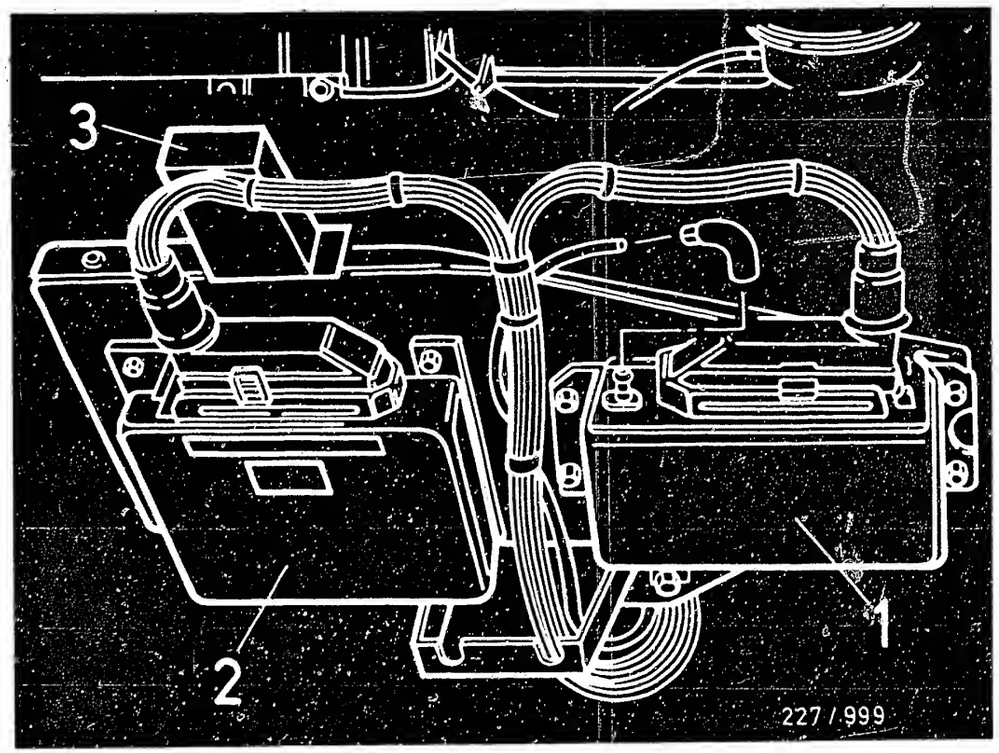
1 = EI control unit
2 = LH-Jetronic control unit
3 = Supply relay, ignition
4 = Supply relay, Jetronic

The control units for the ignition and Jetronic are positioned beneath the glove compartment.

Note on removal:

Remove lower instrument-panel trim and pull trim away downward.

Note: In a right-hand drive vehicle, the installation positioning of these components is a mirror image of that shown with the functions remaining the same.



Installation position of components (continued)

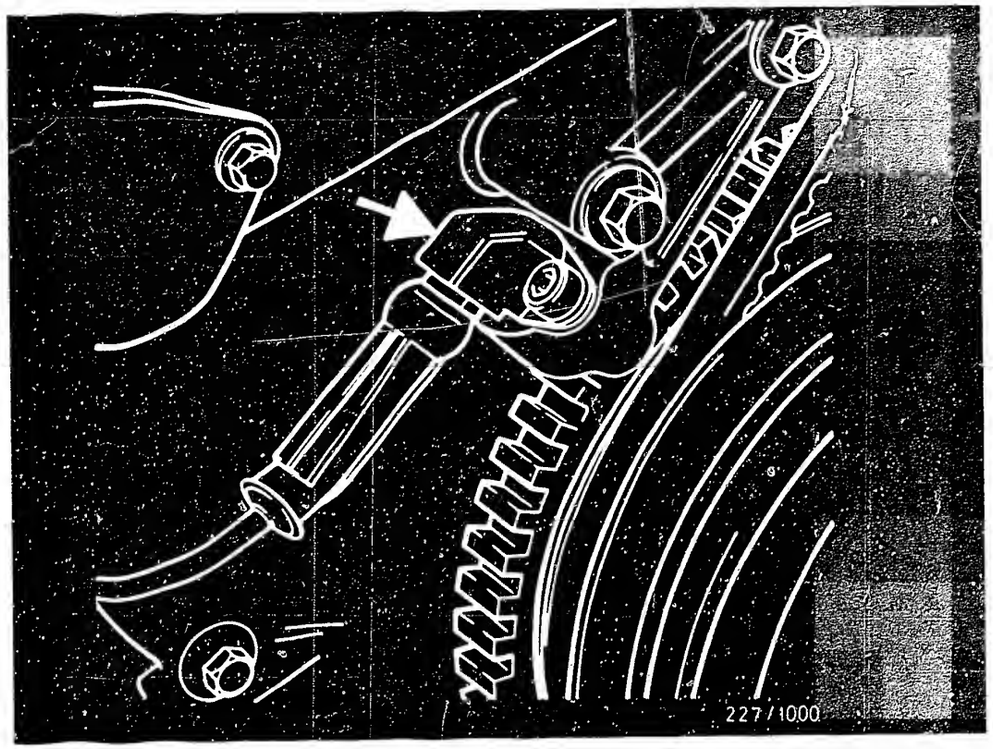
The time-lag relay is positioned close to the Jetronic control unit, see upper illustration.

Further components of the vacuum switch-over facility:

1. Temperature switch: next to the coolant temperature sensor.

2. 3-way solenoid-operated valve: at the rear end of the intake manifold.

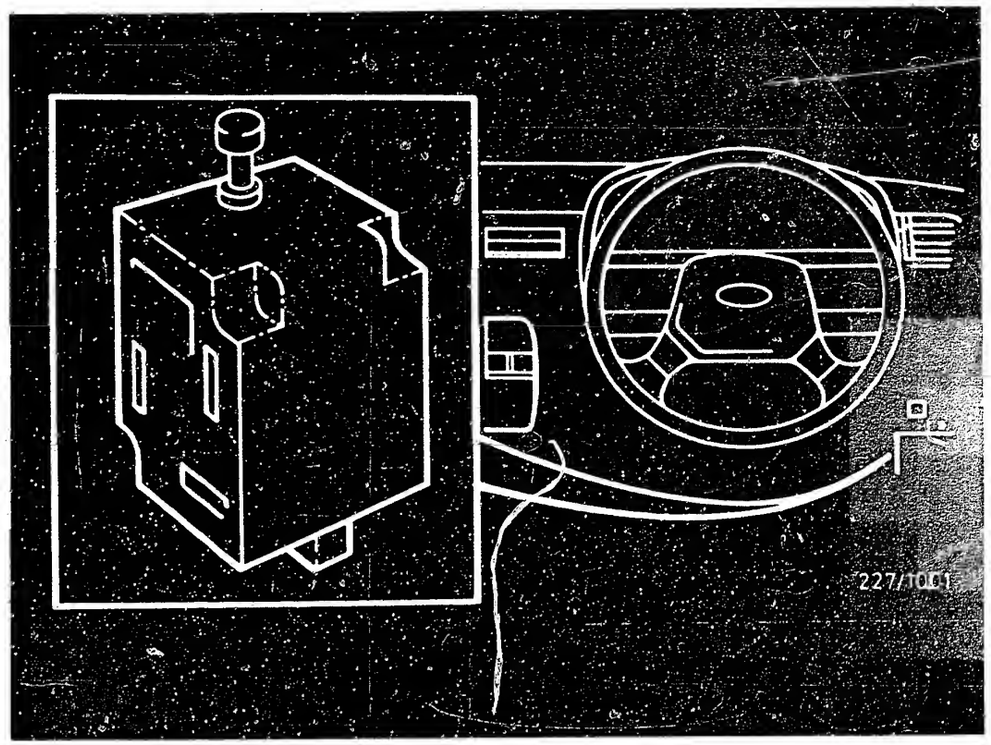
3. Delay valve: in the hose line to the throttle-valve assembly.



Installation position of components (continued)

Arrow = Engine-speed reference-mark sensor

The engine-speed reference-mark sensor is positioned at the end face of the engine behind the crankshaft pulley.



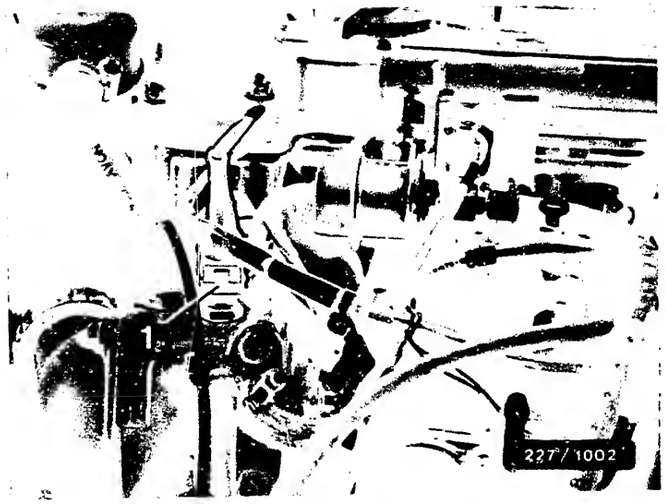
Installation position of components (continued)

The impact switch is positioned on the driver's side behind the side panelling, see upper illustration.

In the case of a heavy impact (accident), the impact switch interrupts the voltage supply to the ignition system and electric fuel pump.
The switch can be reset by pressing the pin on the upper side of the housing.

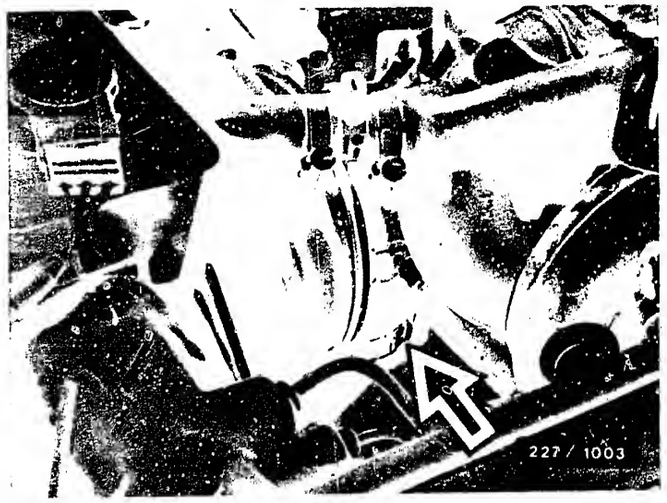
Installation position of components (continued)

The coolant temperature sensor is positioned on the thermostat housing (upper illustration)



The throttle-valve switch is positioned below the throttle-valve assembly, (center illustration) arrow

The high-voltage distributor is mounted on the right-hand side of the engine (lower illustration, 1).
The ignition coil is mounted on the right-hand inner fender, (lower illustration, 2).



T A B L E O F C O N T E N T S

Trouble-shooting instructions : OPE-5001

BOSCH system : Ecotronic (2 Z)

Make of vehicle : OPEL

Basic microcard : PKW - 047

Section	Coordinate
Special features, safety, usage	02
Trouble-shooting chart	04
Self-diagnosis	07
Test specifications	11
Electrical terminal diagram	13
Installation position of components	15

SPECIAL FEATURES

* This microcard contains the ECO2Z trouble-shooting instructions, valid at the time of publication, for the following Opel models:

  Omega 1,8 S (10.86 ->)
  (with S 18 NV and E 18 NV engine)

* Ecotronic with integral characteristic-map ignition (ECO2Z) with 35-pin control unit.

* The control unit is equipped with self-diagnosis. If a fault should arise in the system, it is stored in the fault memory. At the same time, the warning/diagnosis lamp in the instrument panel lights up. If a sensor fails, the control unit operates with specified substitute values.

STRUCTURE, USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to various causes/component faults.
Detailed instructions for trouble-shooting must be taken from the basic instructions via the trouble-shooting chart.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

Finding individual test steps in the brief and basic instructions is made easier through the use of identical test-step numbers.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to prevent damage to the engine, control unit or ignition system, be sure to observe the safety and precautionary measures in the basic instructions.

* C A U T I O N !
  High-performance ignition system.
  Dangerous primary and secondary voltages.

  Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

For further precautionary measures, see basic instructions.

TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.	2. Engine starts but then dies.	3. Rough idling (engine speed, exhaust gas).	4. Poor throttle response, flat spot during acceleration.	5. Engine misfiring (ignition, fuel induction).	6. Maximum engine power/ top speed not reached.	7. Fuel consumption too high.	8. Engine running on (dieseling).	9. Engine pinging/knocking.	10. Engine overheating.	11. Fault lamp.	Cause (component fault)
*	*	*	*	*	*	*	*	*	*	*	Evaluate self-diagnosis
										*	Fault lamp defective
*			*	*							Engine-speed/reference-mark sensor
*											Test primary side
*		*	*	*	*	*					Test secondary side
							*	*			Poor fuel quality
*			*	*	*						Fuel pressure
	*			*	*						Fuel filter
*	*	*	*	*	*	*					Choke-valve flap
*	*			*	*						Float/float-needle valve
*	*	*	*	*	*						Dirt in carburetor
	*	*	*	*	*						Intake system leaking
	*	*									Intake-manifold heating
	*	*									Intake-air preheating
				*							Alternator, interference-suppress.
		*	*								Bypass heating

TROUBLE–SHOOTING CHART (continued)

Customer complaint (symptoms of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.	2. Engine starts but then dies.	3. Rough idling (engine speed, exhaust gas).	4. Poor throttle response, flat spot during acceleration.	5. Engine misfiring (ignition, fuel induction).	6. Maximum engine power/ top speed not reached.	7. Fuel consumption too high.	8. Engine running on (dieseling).	9. Engine pinging/knocking.	10. Engine overheating.	11. Fault lamp.	Cause (component fault)
		*				*					Adjustment, throttle valve Stage I
		*	*	*	*	*					Incorrect type of nozzle
			÷		÷						Vacuum unit, Stage II
		*	*		*						Adjustment, throttle valve Stage II
		*	*								Exhaust–gas recirculation
			*		*	*					Adjustment, accelerator actuation
		*									Idle CO adjustment
		*	*								Throttle valve worn
							*	*			Test octane–rating adaptation
			*								Release and forced return

For production reasons: continued on the following coordinate.

SELF-DIAGNOSIS TEST TABLE

Fault indication Flash code	Testing of component/function	Test instructions/Test conditions	Terminals	Set values
1 2	Control unit, diagnosis output	Control unit indicates that it is in the diagnosis mode.	30	—
1 4	Coolant-temperature sensor (short circuit to ground)	Resistance of temperature sensor: at 20°C at 80°C	13 23 13 23	2...3 k Ω 280...360 Ω
1 5	Coolant-temperature sensor (open circuit)			
2 2	Throttle-valve potentiometer (short circuit to ground and/or open circuit)	Resistance, throttle-valve potentiometer and throttle-valve actuator (parallel): Wiper resistance, throttle-valve potentiometer: Run engine at idle. Seal off ventilating side of throttle-valve actuator. Switch off engine. Switch on ignition. Accelerator pedal in idle position: Accelerator pedal in full-load position: Resistance changes constantly between min. and max.	9 6 9 7 9 7	0,7...1,3 k Ω min. less than 270 Ω max. 1,4...2,4 k Ω
4 1	Intake-manifold temperature (short circuit to ground)	Resistance of temperature sensor: at 20°C at 80°C	22 23 22 23	2...3 k Ω 280...360 Ω
4 3	Intake-manifold temperature sensor (open circuit)			
4 8	Supply voltage too low		4 5 + −	greater than 10 V
4 9	Supply voltage too high	Test alternator/alternator regulator	4 5 + −	less than 15 V
5 1	Control unit defective	After all faults have been read out. Clear fault memory. Run engine briefly. Repeat self-diagnosis output. If a fault is indicated again, replace the control unit.	—	—

H07 — ⟹

H08 — ⟺

SELF-DIAGNOSIS TEST TABLE (Continued)

Fault indication Flash code	Testing of component/functions	Test instructions/Test conditions	Terminals	Set values
5 3	Potentiometer in throttle-valve actuator (open circuit)	Resistance, throttle-valve potentiometer and throttle-valve actuator (parallel):	9 6	0,7...1,3 k Ω
		Wiper resistance, potentiometer in throttle-valve actuator:	28 6 28 6	min. less than 400 Ω max. 1,4...2,6 k Ω
5 4	Potentiometer in throttle-valve actuator (short circuit to ground)	(activate evacuating valve in throttle-valve actuator while testing and pull back throttle-valve actuator with hand vacuum pump.) Resistance decreases continously.		
5 6	Choke-valve actuator, current too high	Insulation resistance of choke-valve actuator:	14 5	greater than 1 M Ω
5 7	Choke-valve actuator, current too low	Winding resistance of choke-valve actuator:	14 15	0,9...1,7 Ω
5 8	Input for CO adjustment (short circuit to ground)	Insulation resistance, input for CO adjustment: (adjustment plug disconnected)	10 5	greater than 1 M Ω
5 9	Throttle-valve actuator extends too slowly	Fault is indicated only if engine is running at idle during diagnosis output.		
6 1	Throttle-valve actuator retracts too slowly	Switch off engine and check time it takes throttle-valve actuator to extend/retract: Retraction: Extension:	—— ——	max. 1 s max. 1 s
6 2	Ventilating valve in throttle-valve actuator	Insulation resistance, ventilating valve: Winding resistance, ventilating valve:	34 5 34 35	greater than 1 M Ω 20...70 Ω
6 3	Evacuating valve in throttle-valve actuator	Insulation resistance, evactuating valve: Winding resistance, evacuating valve:	33 5 33 35	greater than 1 M Ω 20...70 Ω

TEST SPECIFICATIONS:

Idle speed:	830 ± 50 min-1
with idle-speed increase	930 ± 50 min-1
CO adjustment:	
CO value with engine at normal operating temperature	0,2...0,3 % CO by vol.
With CO adjustment plug plugged in	0,5...1,5 % CO by vol.
Fuel pressure:	0,1...0,3 bar
Minimum fuel delivery (at 2000 min-1)	1 l/min
Float weight:	8,3 ± 0,3 g
Float height:	27,5 ± 1,0 mm

(Float level cannot be adjusted

Throttle-valve potentiometer
Total resistance: 1,4...2,6 k Ω
Wiper resistance in correcting range: min. less than 270 Ω
max. 1,4...2,4 k Ω

Choke-valve actuator:
Winding resistance: 0,9...1,7 Ω

Basic setting, throttle valve Stage II: a = 0,05 ± 0,2 mm

Release and forced return Stage II: Y = 0,4 ± 0,3 mm
Z = 0,3 ± 0,2 mm

Tightening torques
Flange mounting 9 Nm

TEST SPECIFICATIONS (continued):

Throttle-valve actuator
evacuating valve (term.1/term.2): 20...70 Ω
ventilating valve (term.6/term.7): 20...70 Ω
Total resistance, potentiometer (term.3/term.4): 1,4...2,6 k Ω
Wiper resistance in correcting range (term.5/term.3):
min. less than 400 Ω
max. 1,4...2,4 k Ω

Inductive engine-speed and reference-mark sensor:
Internal resistance 0,5...0,8 k Ω

Temperature sensor (NTC):
Internal resistance at 20°C: 2...3.2,4 k Ω
at 80°C: 280...360 Ω

Heating element, intake-manifold heating:
Internal resistance at 20°C: 0,6...0,7 Ω

Heating element, bypass heating:
Internal resistance at 20°C: 1,4...2.1 Ω

Type of nozzle:

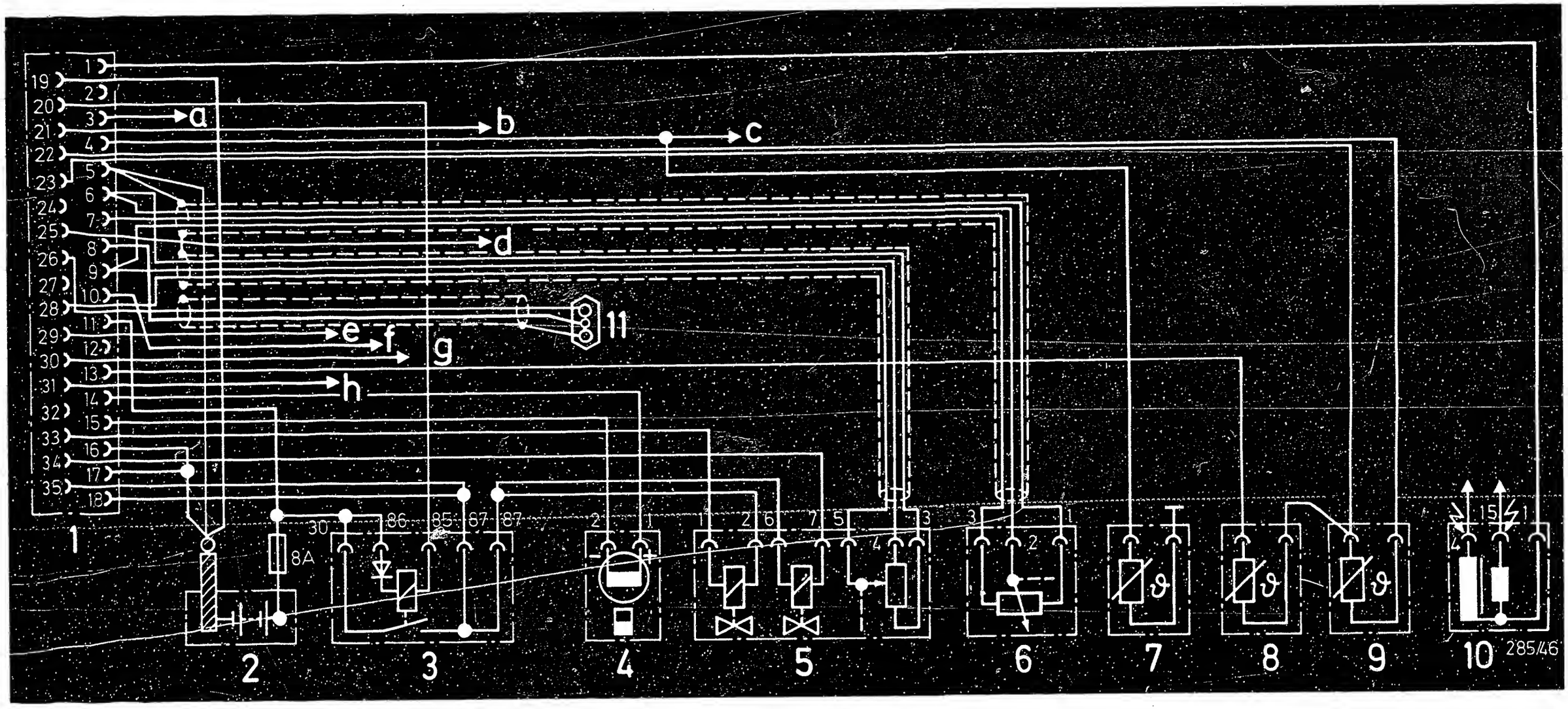
	Stage 1	Stage 2
Main nozzle	x 110	x 135
Idle fuel nozzle	x 52,5	
Air-correction nozzle	x 110	x 70

Coding plug, octane-rating adaptation:

Resistance at:
91 RON: infinity Ohms
95 RON: 0 Ω

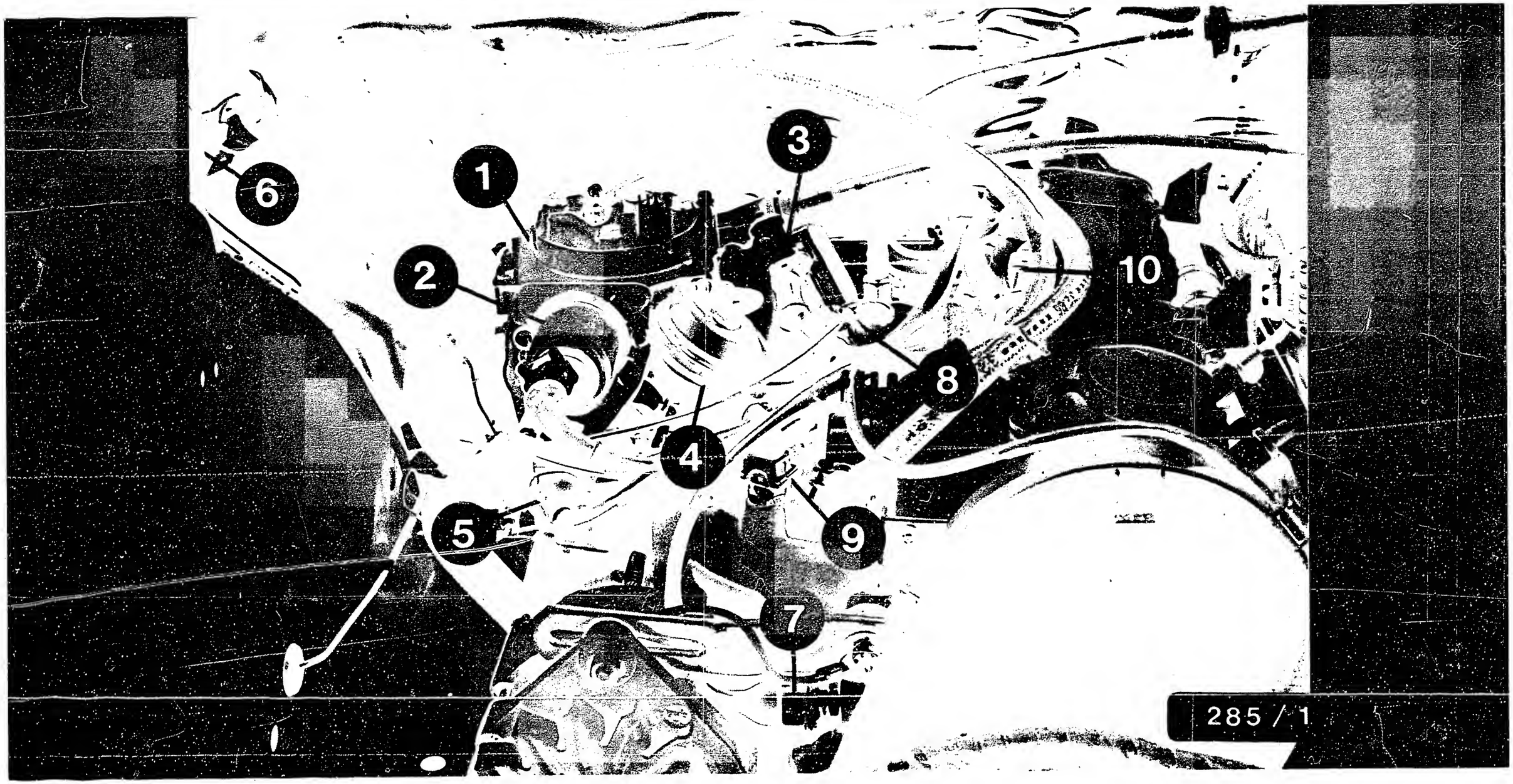
Voltage supply for potentiometer (throttle valve and throttle-valve actuator) and temperature sensor:
4,5...5,5 V

See equipment and Autodata microcards for the setting values for valve clearance and other engine-related data.



ELECTRICAL TERMINAL DIAGRAM

1 = Control unit,Ecotronic with ign.
2 = Battery
3 = Control relay
4 = Choke-valve actuator
5 = Throttle-valve actuator
6 = Potentiometer, main throttle valve (HD pot)
7 = Bypass heating element
8 = Coolant-temperature sensor
9 = Intake-manifold temp. sensor
10 = Ignition coil
11 = Reference-mark sensor
a = To intake-man. heating relay
b = TD output
c = To central electrics
d = Octane-rating adaptation
e = Idle-speed increase (with increase to ground)
f = Input for CO adjustment
g = Diagnostic lamp
h = Diagnosis stimulation lead

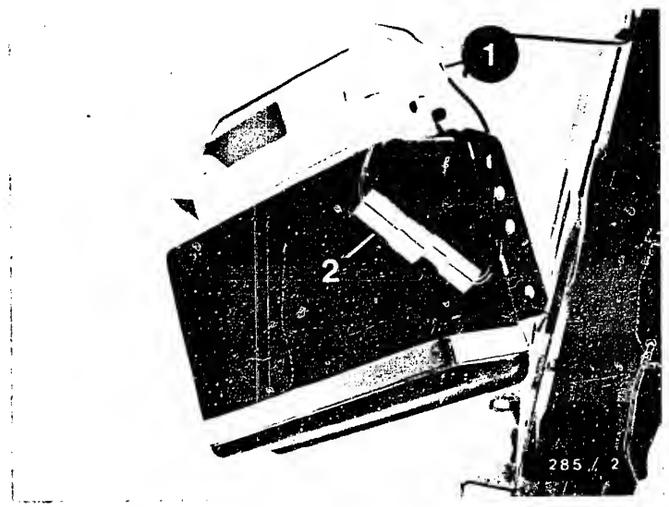


INSTALLATION POSITION OF COMPONENTS

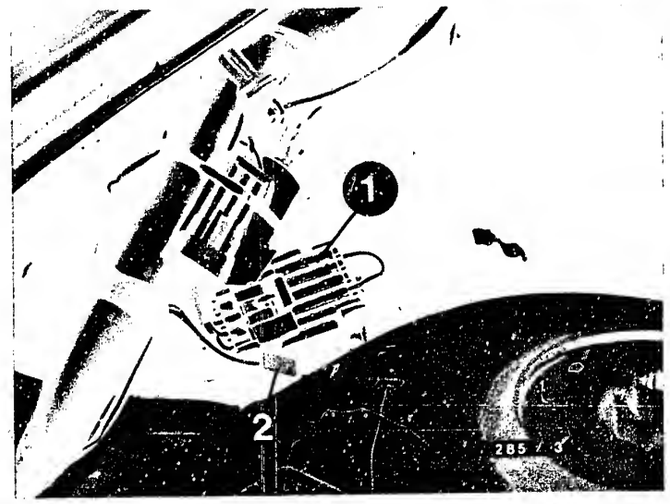
1 = Carburetor
2 = Choke-valve actuator
3 = Throttle-valve positioner
4 = Vacuum unit, stage 2
5 = Throttle-valve potentiometer
6 = Diagnosis plug
7 = Temperature sensor, coolant
8 = Exhaust-gas recirculation valve
9 = Temperature sensor, intake manifold
10 = Plug connection, reference-mark sensor

INSTALLATION POSITION OF COMPONENTS (continued)

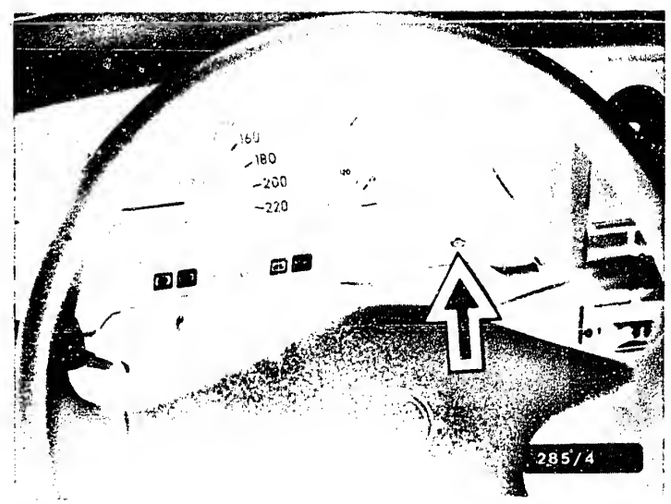
The Ecotronic control unit with integrated ignition is installed in the right footwell beneath the covering (upper illustration). In the illustration, the covering has already been removed. For the purposes of octane-number adaptation, in vehicles with the S 18 NV engine a code strip is located in the wiring harness (upper illustration, 1) and in vehicles with the E 1 NV engine a coding plug is installed in the engine compartment on the right behind the spring-strut dome. The idle speed can be increased by about every 100 min. $^{-1}$ via the plug connection (upper illustration, 2).



The diagnosis plug is installed in the engine compartment on the firewall on the right (center illustration, 1). Plug for CO adjustment (center illustration, 2). If no CO tester is available with which it is possible to measure low CO values, make a plug connection for CO adjustment. The CO value is increased.

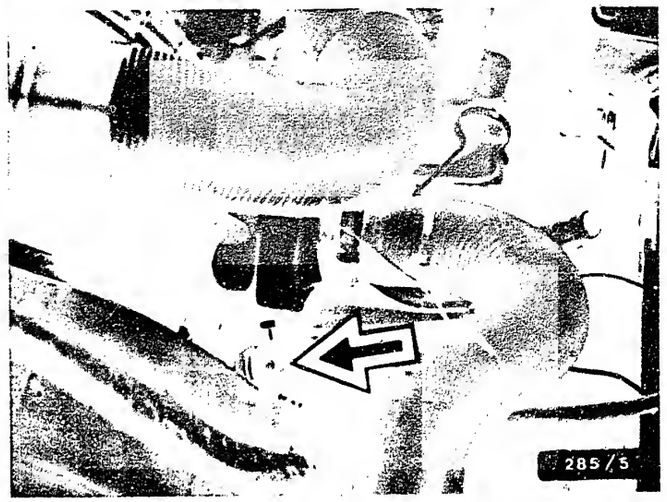


The warning and diagnosis lamp is installed in the instrument panel (lower illustration).

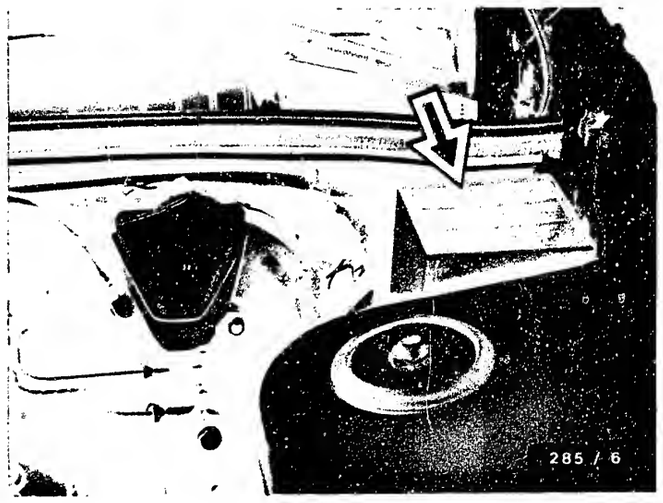


INSTALLATION POSITION OF COMPONENTS (continued)

The reference-mark and engine-speed sensor is mounted on the crankcase on the left as seen from the direction of travel (upper illustration, arrow).



The control relay and relay for intake-manifold preheating are installed beneath the cover (lower illustration, arrow).



T A B L E O F C O N T E N T S

Trouble-shooting instructions	: OPE-5002
BOSCH system	: Ecotronic (2 Z)
Make of vehicle	: OPEL
Basic microcard	: PKW-047

Section	Coordinate
Special features, safety, usage	02
Trouble-shooting chart	04
Self-diagnosis	07
Test specifications	11
Electrical terminal diagram	13
Installation position of components	15

SPECIAL FEATURES

* This microcard contains the ECO2Z trouble-shooting instructions, valid at the time of publication, for the following Opel models:

  Ascona/Kadett 1,8S (10.86 ->)
  (with S 18 NV and E 18 NV engine)

* Ecotronic with integral characteristic-map ignition (ECO2Z) with 35-pin control unit.

* The control unit is equipped with self-diagnosis. If a fault should arise in the system, it is stored in the fault memory. At the same time, the warning/diagnosis lamp in the instrument panel lights up. If a sensor fails, the control unit operates with specified substitute values.

STRUCTURE, USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to various causes/component faults.
Detailed instructions for trouble-shooting must be taken from the basic instructions via the trouble-shooting chart.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

Finding individual test steps in the brief and basic instructions is made easier through the use of identical test-step numbers.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to prevent damage to the engine, control unit or ignition system, be sure to observe the safety and precautionary measures in the basic instructions.

* C A U T I O N !
  High-performance ignition system.
  Dangerous primary and secondary voltages.

  Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

For further precautionary measures, see basic instructions.

TROUBLE-SHOOTING CHART

1. Starting motor operates, but engine fails to start or starts only with difficulty.	2. Engine starts but then dies.	3. Rough idling (engine speed, exhaust gas).	4. Poor throttle response, flat spot during acceleration.	5. Engine misfiring (ignition, fuel induction).	6. Maximum engine power/ top speed not reached.	7. Fuel consumption too high.	8. Engine running on (dieseling).	9. Engine pinging/knocking.	10. Engine overheating.	11. Fault lamp.	Cause (component fault)
*	*	*	*	*	*	*	*	*	*	*	Evaluate self-diagnosis
										*	Fault lamp defective
*			*	*							Engine-speed/reference-mark sensor
*											Test primary side
*		*	*	*	*	*					Test secondary side
								*	*		Poor fuel quality
*			*	*	*						Fuel pressure
	*			*	*						Fuel filter
*	*	*	*	*	*	*					Choke-valve flap
*	*			*	*						Float/float-needle valve
*	*	*	*	*	*						Dirt in carburetor
	*	*	*	*	*						Intake system leaking
	*	*									Intake-manifold heating
	*	*									Intake-air preheating
				*							Alternator, interference-suppress.
		*	*								Bypass heating

TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.	2. Engine starts but then dies.	3. Rough idling (engine speed, exhaust gas).	4. Poor throttle response, flat spot during acceleration.	5. Engine misfiring (ignition, fuel induction).	6. Maximum engine power/ top speed not reached.	7. Fuel consumption too high.	8. Engine running on (dieseling).	9. Engine pinging/knocking.	10. Engine overheating.	11. Fault lamp.	Cause (component fault)
	*			*							Adjustment, throttle valve stage I
	*	*	*	*	*						Incorrect type of nozzle
		*		*							Vacuum unit, stage II
	*	*		*							Adjustment, throttle valve stage II
		*		*	*						Adjustment, accelerator actuation
	*										Idle CO adjustment
	*	*									Throttle valve worn
							*	*			Test octane-rating adaptation
		*									Release and forced return

For production reasons: continued on the following coordinate.

SELF-DIAGNOSIS TEST TABLE

Fault indication Flash code	Testing of component/function	Test instructions/Test conditions	Termi-nals	Set values
1 2	Control unit, diagnosis output	Control unit indicates that it is in the diagnosis mode.	30	—
1 4	Coolant-temperature sensor (short circuit to ground)	Resistance of temperature sensor: at 20°C at 80°C	13 23 13 23	2...3 k Ω 280...360 Ω
1 5	Coolant-temperature sensor (open circuit)			
2 2	Throttle-valve potentiometer (short circuit to ground and/or open circuit)	Resistance, throttle-valve potentiometer and throttle-valve actuator (parallel): Wiper resistance, throttle-valve potentiometer: Run engine at idle. Seal off ventilating side of throttle-valve actuator. Switch off engine. Switch on ignition. Accelerator pedal in idle position: Accelerator pedal in full-load position: Resistance changes constantly between min. and max.	9 6 9 7 9 7	0,7...1,3 k Ω min. less than 270 Ω max. 1,4...2,4 k Ω
4 1	Intake-manifold temperature (short circuit to ground)	Resistance of temperature sensor: at 20°C at 80°C	22 23 22 23	2...3 k Ω 280...360 Ω
4 3	Intake-manifold temperature sensor (open circuit)			
4 8	Supply voltage too low		4 5 + −	greater than 10 V
4 9	Supply voltage too high	Test alternator/alternator regulator	4 5 + −	less than 15 V
5 1	Control unit defective	After all faults have been read out. Clear fault memory. Run engine briefly. Repeat self-diagnosis output. If a fault is indicated again, replace the control unit.	—	—

SELF-DIAGNOSIS TEST TABLE (Continued)

Fault indication Flash code	Testing of component/functions	Test instructions/Test conditions	Terminals	Set values
5 3	Potentiometer in throttle-valve actuator (open circuit)	Resistance, throttle-valve potentiometer and throttle-valve actuator (parallel): Wiper resistance, potentiometer in throttle-valve actuator: (activate evacuating valve in throttle-valve actuator while testing and pull back throttle-valve actuator with hand vacuum pump.) Resistance decreases continously.	9 6 28 6 28 6	0,7...1,3 k Ω min. less than 400 Ω max. 1,4...2,6 k Ω
5 4	Potentiometer in throttle-valve actuator (short circuit to ground)			
5 6	Choke-valve actuator, current too high	Insulation resistance of choke-valve actuator:	14 5	greater than 1 M Ω
5 7	Choke-valve actuator, current too low	Winding resistance of choke-valve actuator:	14 15	0,9...1,7 Ω
5 8	Input for CO adjustment (short circuit to ground)	Insulation resistance, input for CO adjustment: (adjustment plug disconnected)	10 5	greater than 1 M Ω
5 9	Throttle-valve actuator extends too slowly	Fault is indicated only if engine is running at idle during diagnosis output.		
6 1	Throttle-valve actuator retracts too slowly	Switch off engine and check time it takes throttle-valve actuator to extend/retract: Retraction: Extension:	—— ——	max. 1 s max. 1 s
6 2	Ventilating valve in throttle-valve actuator	Insulation resistance, ventilating valve: Winding resistance, ventilating valve:	34 5 34 35	greater than 1 M Ω 20...70 Ω
6 3	Evacuating valve in throttle-valve actuator	Insulation resistance, evactuating valve: Winding resistance, evacuating valve:	33 5 33 35	greater than 1 M Ω 20...70 Ω

TEST SPECIFICATIONS:

Idle speed:	830 ± 50 min-1
with idle-speed increase	930 ± 50 min-1
CO adjustment:	
CO value with engine at normal operating temperature	0,2...0,3 % CO by vol.
With CO adjustment plug plugged in	0,5...1,5 % CO by vol.
Fuel pressure:	0,1...0,3 bar
Minimum fuel delivery (at 2000 min-1)	1 l/min
Float weight:	8,3 ± 0,3 g
Float height:	27,5 ± 1,0 mm
(Float level cannot be adjusted	
Throttle-valve potentiometer	
Total resistance:	1,4...2,6 k Ω
Wiper resistance in correcting range: min.	less than 270 Ω
max.	1,4...2,4 k Ω
Choke-valve actuator:	
Winding resistance:	0,9...1,7 Ω
Basic setting, throttle valve Stage II:	a = 0.05 ± 0,02 mm
Release and forced return Stage II:	Y = 0,4 ± 0,3 mm
	Z = 0,3 ± 0,2 mm
Tightening torques	
Flange mounting	9 Nm

TEST SPECIFICATIONS (continued):

Throttle-valve actuator	
evacuating valve (term.1/term.2):	20...70 Ω
ventilating valve (term.6/term.7):	20...70 Ω
Total resistance, potentiometer (term.3/term.4):	1,4...2,6 k Ω
Wiper resistance in correcting range (term.5/term.3):	
min.	less than 400 Ω
max.	1,4...2,4 k Ω
Inductive engine-speed and reference-mark sensor:	
Internal resistance	0,5...0,8 k Ω
Temperature sensor (NTC):	
Internal resistance at 20°C:	2...3 k Ω
at 80°C:	280...360 Ω
Heating element, intake-manifold heating:	
Internal resistance at 20°C:	0,6...0,7 Ω
Heating element, bypass heating:	
Internal resistance at 20°C:	1,4...2,1 Ω

Type of nozzle:

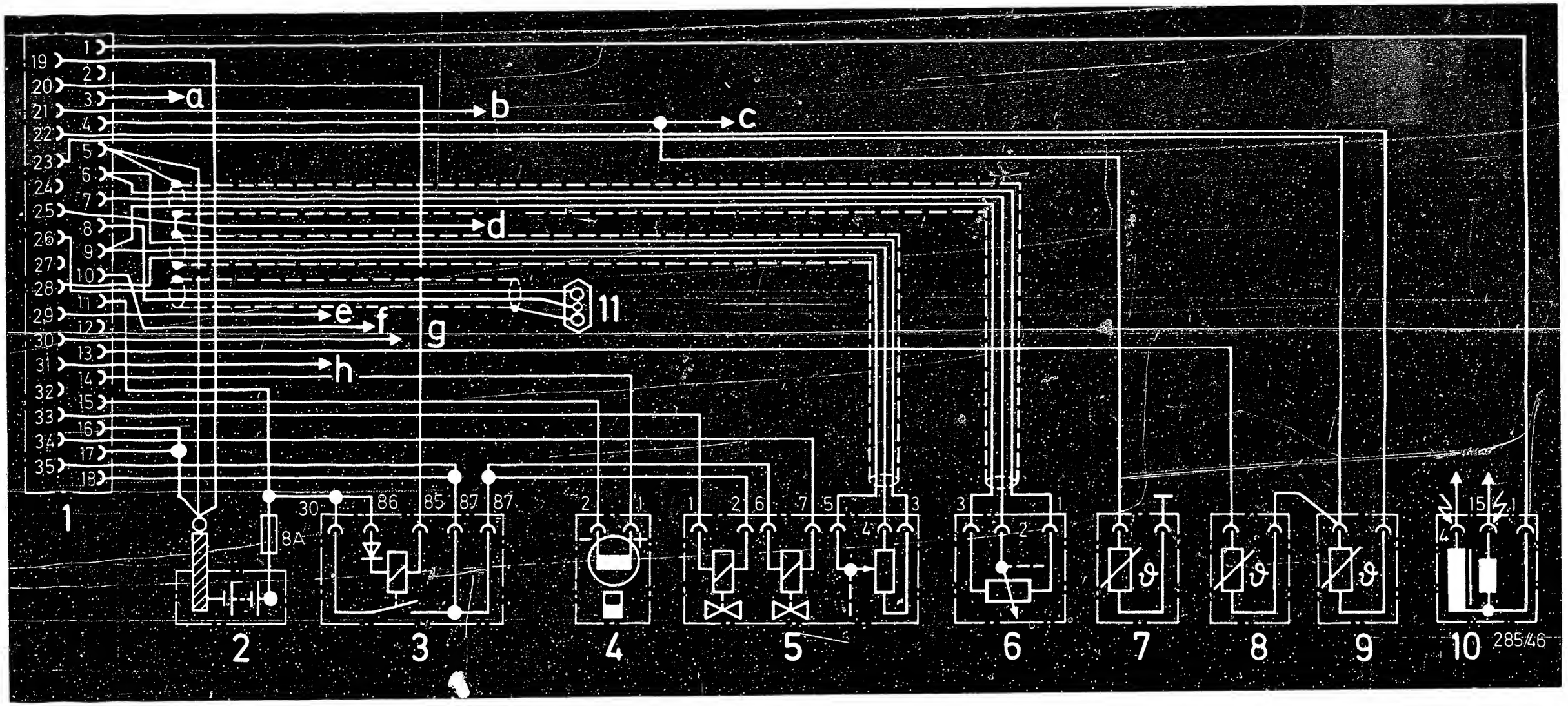
	Stage 1	Stage 2
Main nozzle	x 110	x 135
Idle fuel nozzle	x 52,5	
Air-correction nozzle	x 110	x 70

Coding plug, octane-rating adaptation:

Resistance at:
91 RON: infinity Ohms
95 RON: 0 Ω

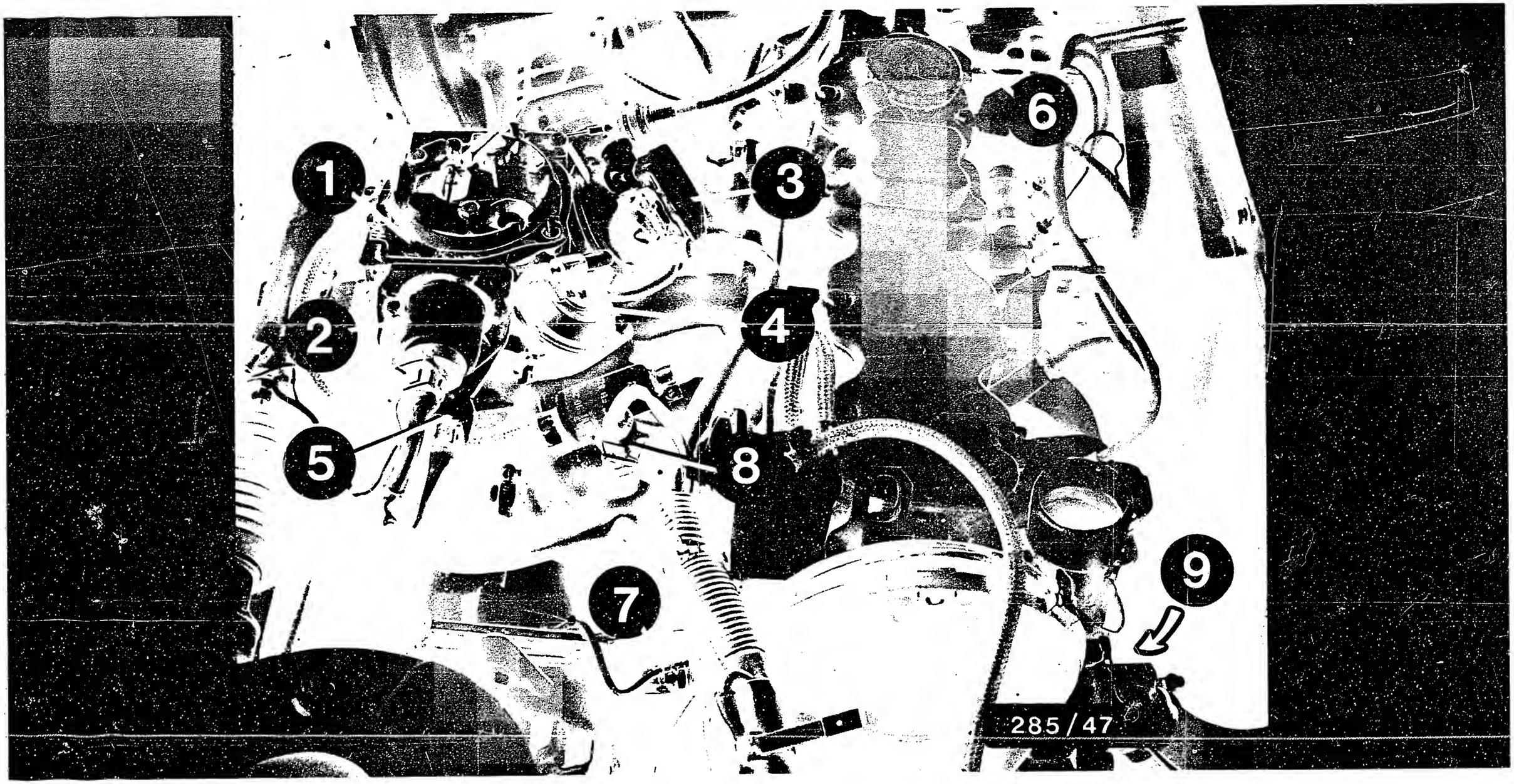
Voltage supply for potentiometer (throttle valve and throttle-valve actuator) and temperature sensor:
4,5...5,5 V

See equipment and Autodata microcards for the setting values for valve clearance and other engine-related data.



ELECTRICAL TERMINAL DIAGRAM

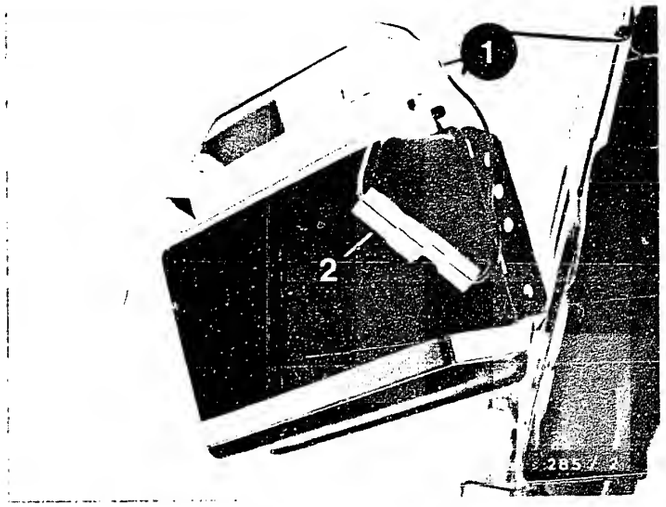
1 = Control unit,Ecotronic with ign.
2 = Battery
3 = Control relay
4 = Choke-valve actuator
5 = Throttle-valve actuator
6 = Potentiometer, main throttle valve (HD pot)
7 = Bypass heating element
8 = Coolant-temperature sensor
9 = Intake-manifold temp. sensor
10 = Ignition coil
11 = Reference-mark sensor
a = To intake-man. heating relay
b = TD output
c = To central electrics
d = Octane-rating adaptation
e = Idle-speed increase (with increase to ground)
f = Input for CO adjustment
g = Diagnostic lamp
h = Diagnosis stimulation lead



INSTALLATION POSITION OF COMPONENTS

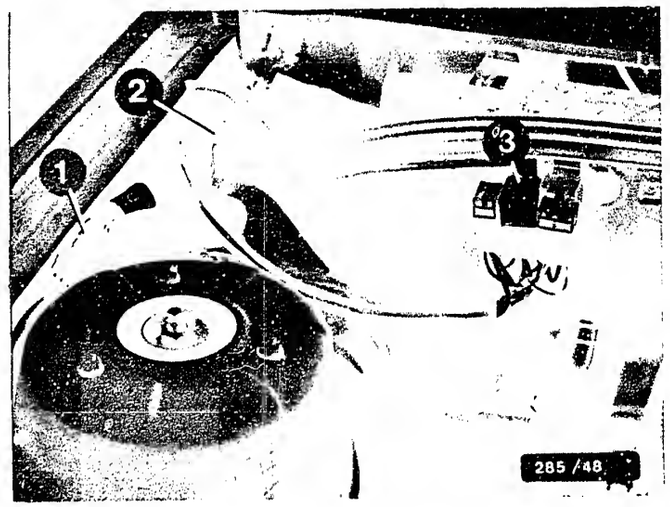
1 = Carburetor
2 = Choke-valve actuator
3 = Throttle-valve actuator
4 = Vacuum unit stage 2
5 = Throttle-valve potentiometer
6 = High-voltage distributor
7 = Coolant-temperature sensor
8 = Intake-manifold temp. sensor
9 = Reference-mark sensor

The Ecotronic control unit with integral ignition is installed in the right-hand footwell beneath the cover (upper illustration). The cover has already been removed in the illustration.
For the purpose of octane-rating adaptation, a coding loop has been installed in the wiring harness in vehicles with the S 18 NV engine (upper illustration, 1), and a coding plug has been installed in the engine compartment on the right-hand side behind the spring-strut dome in vehicles with the E 18 NV engine.
The engine speed can be increased by approx. 100 min^{-1} via this plug connection (upper illustration, arrow 2).

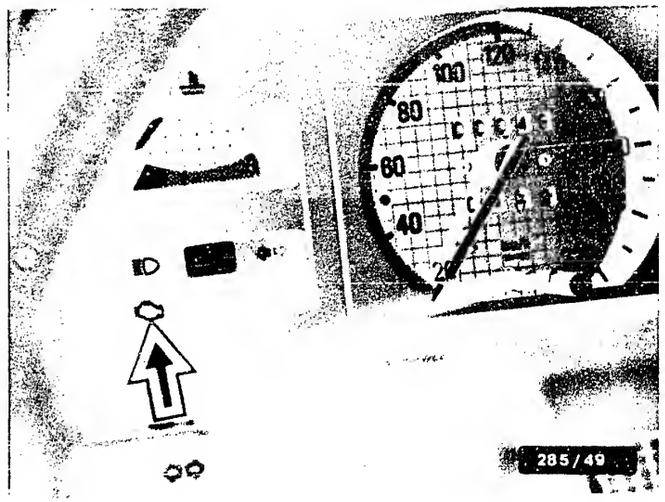


The diagnostic plug is located in the engine compartment on the right-hand side behind the spring strut (center illustration, 1).
Plug for CO adjustment (center illustration, 2).
If a CO analyzer with which small CO values can be measured is not available, create a plug connection for CO adjustment. CO value is increased.

Control relay and intake-manifold heating relay are installed on the firewall (center illustration, 3).



The warning and diagnostic lamp is installed in the instrument panel (lower illustration, arrow).



T A B L E O F C O N T E N T S

Trouble-shooting instructions: VWW-5003

BOSCH system : Ecotronic (4.0)

Make of vehicle : VWW

Basic microcard : MB-530

Section	Coordinate
Special features, safety, usage	02
Trouble-shooting chart	05
Rapid diagnosis chart for universal test adapter	07
Test specifications	15
Electrical terminal diagram	17
Installation position of components	19

SPECIAL FEATURES

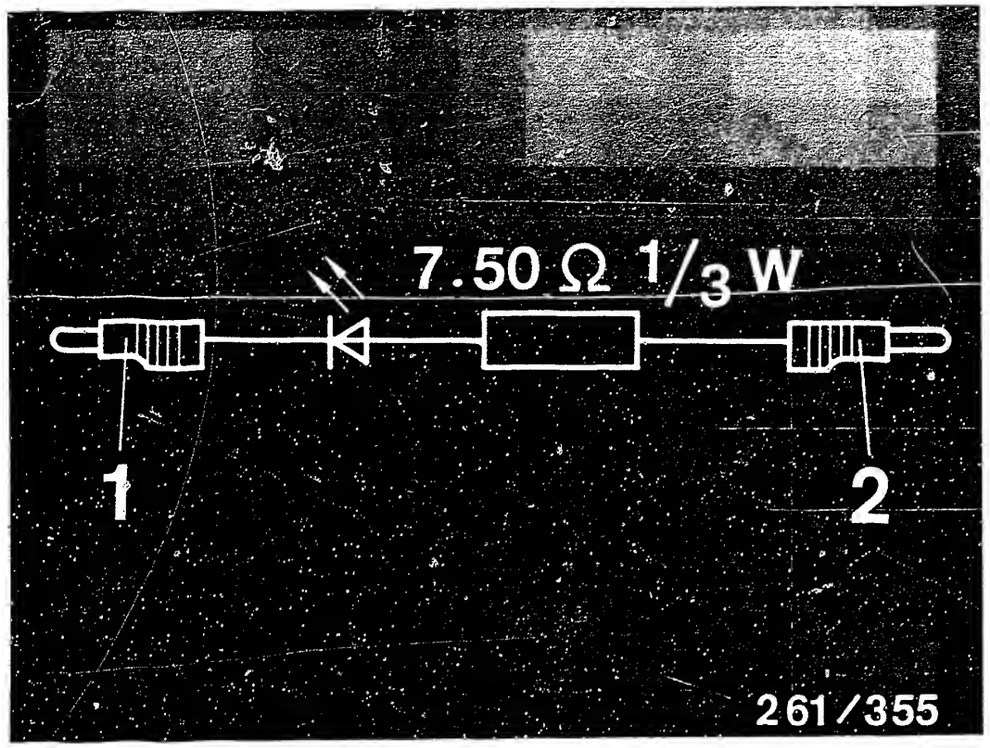
* This microcard contains the ECO 4.0 trouble-shooting instructions, valid at the time of publication, for the following VWmodels:

  Golf 1,6 l and Passat 1,6 l
  with manually shifted transmission
  (03.87 ->)

* Ecotronic with lambda closed-loop control (ECO 4.0) with 25-pin control unit.

* If a sensor fails, the control unit operates with specified substitute values.

* The system is similar to the Ecotronic (ECO 3), MB 190, 200 see SIS MB-530.



SPECIAL FEATURES (Continued)

In addition to the testers described in the basic instructions, another test lead (self-fabricated) is required for adjusting the lambda closed-loop control range (see illustration).

1 = Connection for LED at unassigned lead in engine compartment

2 = Connection for U_B

STRUCTURE, USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to various causes/component faults.
Detailed instructions for trouble-shooting must be taken from the basic instructions via the trouble-shooting chart.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

Finding individual test steps in the brief and basic instructions is made easier through the use of identical test-step numbers.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to prevent damage to the engine, control unit or ignition system, be sure to observe the safety and precautionary measures in the basic instructions.

* C A U T I O N !
  High-performance ignition system.
  Dangerous primary and secondary voltages.

  Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

For further precautionary measures, see basic instructions.

TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty	2. Engine starts but then dies.	3. Rough idling (engine speed, exhaust gas)	4. Poor throttle response, flat spot during acceleration	5. Engine misfiring (ignition, fuel induction)	6. Maximum engine power/ top speed not reached	7. Fuel consumption too high	8. Engine running on (dieseling)	9. Engine pinging/knocking.	10. Engine overheating.	11. Fault lamp	Cause (component fault)
*	*	*	*	*	*	*	*	*	*		Test with universal adapter
							*	*			Fuel not to DIN
*			*	*	*						Fuel pressure outside tolerance
	*			*	*						Fuel delivery outside tolerance
*	*	*	*	*	*	*					Choke-valve flap stiff
*	*			*	*						Float/float-needle valve
*	*	*	*	*	*						Dirt in carburetor
	*	*	*	*	*						Induction system leaking
	*	*									Intake-manifold heating
	*	*									Intake-air preheating
		*				*					Adjustment, throttle valve stage I
		*	*	*	*	*					Incorrect nozzle type
			*		*						Vacuum unit stage II
		*	*		*						Adjustment, throttle vlv. stage II
			*		*	*					Adjustment, accelerator actuation
		*	*								Throttle valve worn

K05 —· ⟹

TROUBLE-SHOOTING CHART (continued)

Customer complaint (symptoms of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.	2. Engine starts but then dies.	3. Rough idling (engine speed, exhaust gas)	4. Poor throttle response, flat spot during acceleration.	5. Engine misfiring (ignition, fuel induction)	6. Maximum engine power/ top speed not reached.	7. Fuel consumption too high.	8. Engine running on (dieseling).	9. Engine pinging/knocking.	10. Engine overheating.	11. Fault lamp.	Cause (component fault)
	*										Idle adjustment
	*	*	*								Bypass heating defective
	*	*	*	*	*						Exhaust-gas system defective
	*	*	*	*	*						Lambda sensor defective
	*	*	*	*	*	*	*	*			Test ignition system
		*		*							Release/forced return, stage II.

K06 — ⟸

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01
Adapter lead: 1 684 146 182

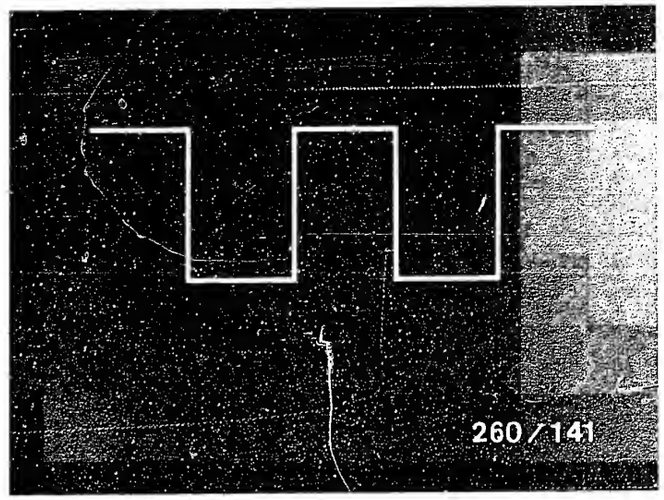
Test step	Switch V	Switch Ω	Testing of component/function	Test instructions/ Test conditions	Termi-nals		Set values
1	V	1	Choke-valve actuator, insulation resistance	Make bridge, socket 1/socket 2 to universal test adapter. Ignition switched off, control unit not connected.	12	2	Greater than 1M Ω
1.1	V	2	Intake-manifold heating relay, winding resistance		14	2	Less than 100 Ω
2	V	3	Choke-valve actuator winding resistance		12	10	Less than 10 Ω
3	V	9	Coolant-temperature sensor	Set value is temperature-dependent: at + 20°C:	21	7	2...3 k Ω
				at + 80°C:	21	7	280...360 Ω
3.1	V	10	Intake-manifold temperature sensor	Set value is temperature-dependent: at + 20°C:	5	7	2...3 k Ω
				at + 80°C:	5	7	280...360 Ω
4	V	7	Ground cables, resistance		20	2	Less than 10 Ω
4.1	V	12	Solenoid-operated valve, evacuating, in throttle-valve actuator, insulation resistance		9	2	Greater than 1 M Ω
4.2	V	13	Solenoid-operating valve, ventilating, in throttle-valve actuator, insulation resistance		3	2	Greater than 1M Ω
5	V	17	Solenoid-operated valve, evacuating, in throttle-valve actuator, winding resistance		9	23	20...80 Ω
6	V	18	Solenoid-operated valve, ventilating, in throttle-valve actuator, winding resistance		3	23	20...80 Ω
8	V	20	Resistance, potentiometers, throttle-valve actuator and throttle valve	Potentiometers are connected in parallel	18	7	0,7...1,3 k Ω

K07 ⟹

K08 ⟺

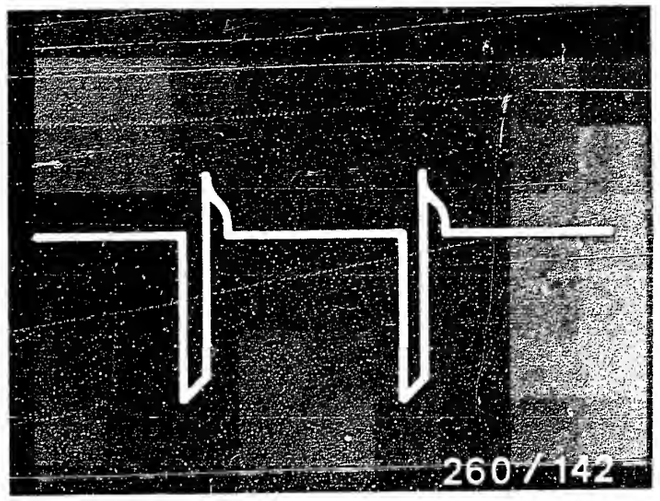
RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 Continued
Adapter lead: 1 684 146 182

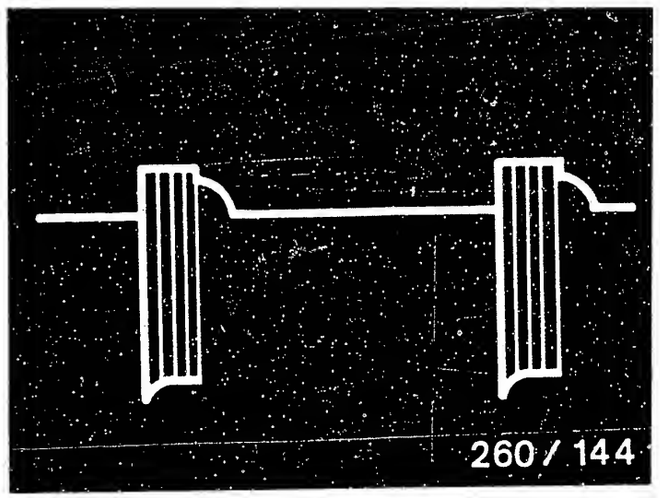
Test step	Switch V	Switch Ω	Testing of component/function Test instructions/conditions	Termi-nals		Set values
10	3	20	Supply voltage, control unit (Control unit connected)	1	2	Greater than 10 V
10.1	4	20	Switch on ignition. Voltage supply of solenoid-operated valves in throttle-valve actuator.	23	2	Greater than 10 V
11	5	20	Connect ignition oscilloscope with black clip to black measuring recess and with red clip to red measuring recess of universal test adapter. Engine is running and at normal operating temperature. Measurement of engine-speed signal and pulses during starting procedure.	25	2	See upper illustration
12	6	20	Voltage supply term.15	13	2	Greater than 10 V
13	7	20	Supply voltage for potentiometers (throttle valve and throttle-valve actuator)	18	2	4,5...5,5 V
14	8	20	Voltage supply, hedgehog-heating relay in intake manifold	14	2	Greater than 10 V
16	10	20	Test throttle-valve actuator: remove bridge socket 1/socket 2 at universal test adapter. Press push-button T3 at universal test adapter. Rod of throttle-valve actuator moves into overrun position. Engine dies. Value may change a max. of 0,2 V within 30 seconds.	17	2	0,1...0,8 V V After approx. 30 s. + max. 0,2 V



RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 Continued
Adapter lead: 1 684 146 182

Test step	Switch V	Switch Ω	Testing of component/function Test instructions/conditions	Terminals	Set values
17	11	20	Test throttle-valve potentiometer: slowly push accelerator pedal to floor. Voltage value increases continuously between min. and max. .	11 2 11 2	Min: 0,05...0,6 V Max: 4,2...5,5 V
18	10	20	Test throttle-valve actuator (ventilating side): Apply lead from socket 2 at universal test adapter 1 s. to ground (e.g. black measuring recess). Attention: under no circumstances allow socket 1 at universal test adapter to make contact with positive (e.g. red measuring recess)	17 2	0,3...1,0 V After 1 s. V 2,8...4,2 V
19	12	20	Measurement of signal for choke-valve actuator: Make bridge socket 1/socket 2 at universal test adapter. Start engine.	12 2	See upper illustration
20	12	20	As 19, however, signal becomes wider when push-button T5 at universal test adapter is pressed (simulation, cold engine)	12 2	See lower illustration
21	12	20	Acceleration enrichment: Briefly actuate accelerator pedal. Signal becomes wider.	12 2	See lower illustration
23	13	20	Actuation of ventilating valve in throttle-valve actuator: Switch off ignition. Then pay attention to time and voltage value!	3 2 3 2	Greater than 10 V after approx. 5...20 s Less than 1 V





RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 Continued
Adapter lead: 1 684 146 182

Test step	Switch V	Switch Ω	Testing of component/function Test instructions/conditions	Terminals		Set values
24	14	20	Start engine. Actuation of evacuating valve in throttle-valve actuator: Switch on ignition. Then pay attention to time and voltage value!	9 9 9	2 2 2	Less than 1 V after approx. 12 s Greater than 10 V after further approx. 3 s Less than 1 V
26	23	20	Lambda closed-loop control, open-loop control value at test output. Connect test lead with LED to unassigned lead in engine compartment. Engine runs and has normal operating temperature	6	2	LED flashes at high frequency
27	23	22	Lambda closed-loop control, rich value at test output	6	2	LED goes out
28	23	23	Lambda closed-loop control, lean value at test output	6	2	LED lights up
29	23	24	Lambda closed-loop control, closed-loop control value at test output	6	2	LED flashes at approx. 2 Hz
29.1	18	20	Transmission identification Vehicles with manually shifted transmission: Vehicles with automatic transmission:	16 16	2 2	Approx. 0...5 V Greater than 6 V
31	—	—	Test CO value. Connect CO analyzer to exhaust-sample pipe in front of the catalytic converter. (Hose for crankshaft ventilation disconnected; lead to lambda sensor disconnected).	——		% CO by vol.

TEST SPECIFICATIONS:

Idle speed: 900 ± 75 min-1

Adjust lambda closed-loop-control range:

Run engine to warm up until at normal operating temperature (approx. 80°C). Increase engine speed for 30 s. to greater than 2000 min $^{-1}$, so that the lambda sensor is sure to be at normal operating temperature. Afterwards, immediately connect test lead to unassigned lead in engine compartment and to battery term.30. Run engine at idle. LED of test lead must flash at approx. 1,5 Hz. If necessary, adjust at idle-mixture-adjusting screw.

Exhaust-gas adjustment:
Test CO value with engine at normal operating temperature (in vehicles with lambda closed-loop control, test at sampling pipe before catalytic converter): 0,2...1,0 %CO by vol.

Fuel pressure: 0,1...0,3 bar

Minimum fuel delivery
(at 2000 min-1) 1 l/min

Float weight: 7,9 ± 0,5 g
Float height: 27,5 ± 1,0 mm
(Float cannot be adjusted)

Throttle-valve potentiometer
Total resistance: 1,4...2,6 k Ω
Wiper resistance in correcting range: min. less than 270 Ω
max. 1,4...2,4 k Ω

Choke-valve actuator:
Winding resistance: 0,9...1,7 Ω

Basic setting, throttle valve
Stage I (with feeler gauge) 3,15 ± 0,1 mm
Stage II a = 0,03 ± 0,02 mm

TEST SPECIFICATIONS (continued):

Release and forced return
Stage II: Y = 1,0 ± 0,2 mm
Z = 0,4 ± 0,2 mm

Winding resistance, intake-manifold heating relay: 20...50 Ω

Throttle-valve actuator
Evacuating valve (term.1/term.2): 20...70 Ω
Ventilating valve (term.6/term.7): 20...70 Ω
Total resistance, potentiometer (term.3/term.4): 1,4...2,6 k Ω
Wiper resistance in correcting range (term.5/term.3): min. less than 400 Ω
max. 1,4...2,4 k Ω

Temperature sensor (NTC:
Internal resistance at 20°C: 2,0...3,0 k Ω
at 80°C: 280...360 Ω

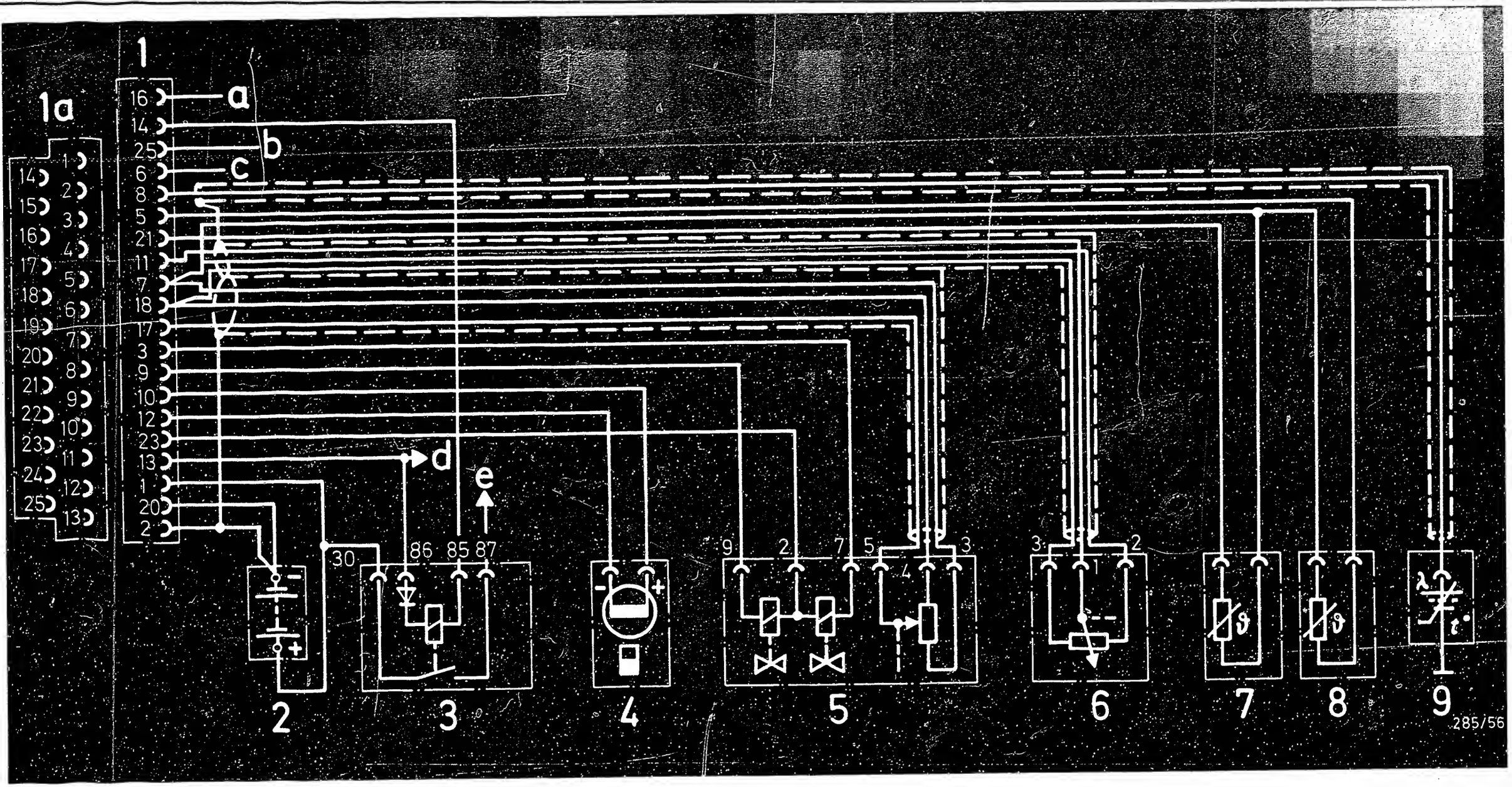
Heating element, intake-manifold heating:
Internal resistance at 20°C: approx. 1,5 Ω

Type of nozzle:

	Stage 1	Stage 2
Main nozzle	x 105	x 110
Idle fuel nozzle	x 45	
Acceleration fuel nozzle		90
Air correction nozzle (with mixing tube)	x 110	x 105
Acceleration air nozzle		x 130
Full-load enrichment		100±10

Tightening torques
Carburetor mounting 7 Nm
Flange mounting 13 Nm

See equipment and Autodata microcards for setting values for valve clearance and other engine-related data.

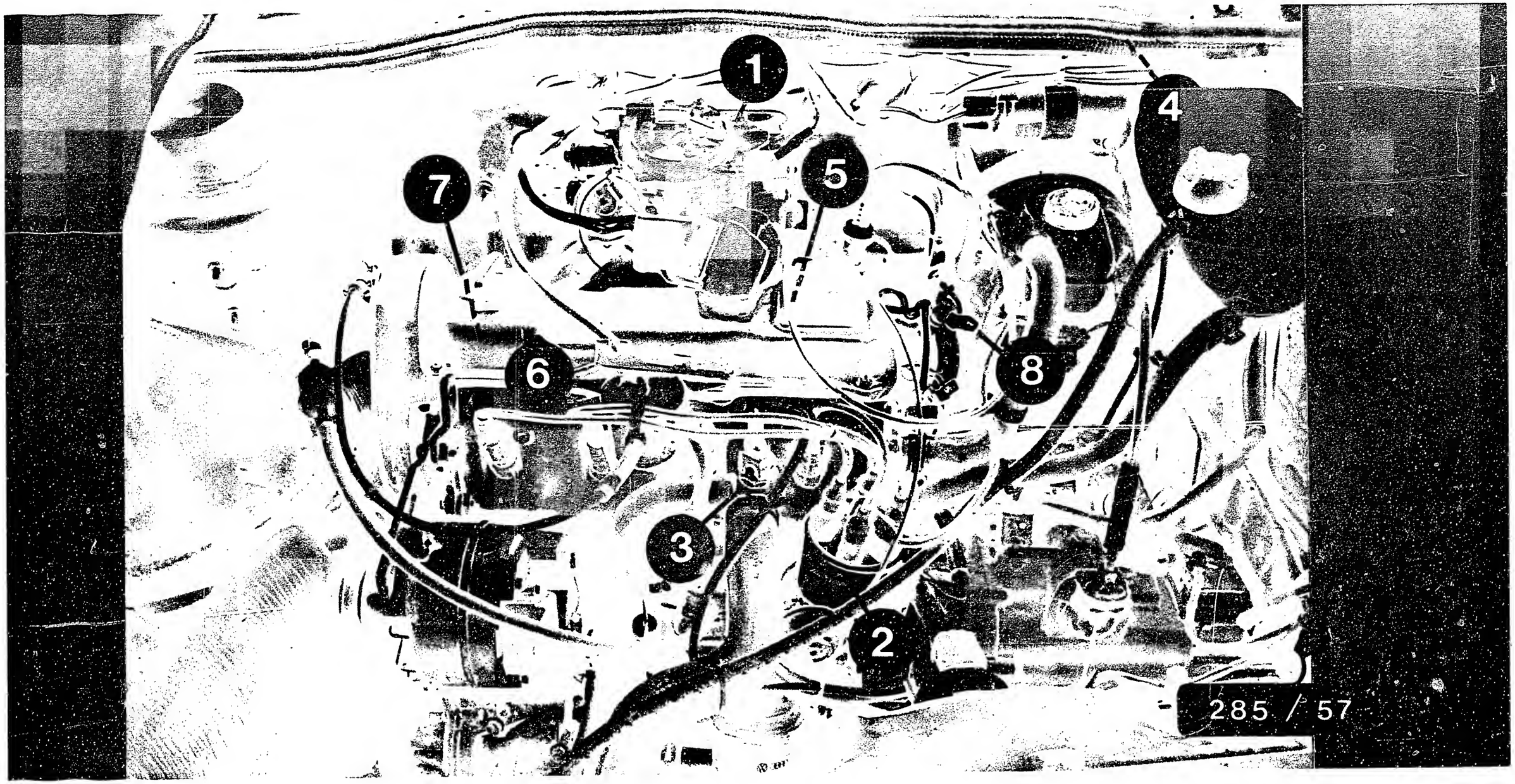


Electrical terminal diagram of the Ecotronic

1 = Control unit, Ecotronic
1a= Plug assignment
2 = Battery
3 = Relay, intake-manifold heating
4 = Choke-valve actuator
5 = Throttle-valve actuator (DKA)
6 = Potentiometer, main throttle valve
7 = Coolant-temperature sensor
8 = Intake-manifold temp. sensor
9 = Lambda sensor

a = Transmission identification
b = Td Signal
c = Unassigned lead for setting the control range of the lambda sensor
d = Term. 15
e = To heating element, intake-manifold heating

K17 ⟹ | K18 ⟸



Installation position of components

1 = Carburetor
2 = Ignition distributor
3 = Coolant-temperature sensor
4 = Control unit, Ecotronic (beneath cover)
5 = Intake-manifold temp. sensor
6 = Vapor-bubble separator
7 = Sampling pipe for CO measurement
8 = Unassigned lead for adjustment of control range of lambda sensor

Lambda sensor is installed in exhaust manifold

Note: Installation position in Passat identical; engine is installed longitudinally.

Trouble-shooting instructions: AUD-5001

BOSCH system : K - Jetronic

Vehicle make : AUDI

Basic microcard : VWW-504

TABLE OF CONTENTS

Section	Coordinate
Special features	02
Safety and precautionary measures	03
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Test specifications	05
Electrical terminal diagram	09
Bridging the safety circuit	11
Diagram of air/fuel lines	13
Installation position of components	15

SPECIAL FEATURES

These trouble-shooting instructions apply to the following Audi models, valid at the time of compilation:

* AUDI 80 GTE 01.86 ->
  Engine DZ, MU / 1.8 ltr./ 4 cyl.
  K-Jetronic

* Updraft mixture-control unit

* Air-shrouded injection valves

* Pressure-operated snap-action switch for cold-acceleration enrichment

* Idle-speed-increase valve 1 for increasing engine speed when idle speed falls below approx. 700 min^{-1} .

* Idle-speed-increase valve 2 for increasing engine speed when air conditioner is switched on (if fitted).

Important note: if reference is made to a basic microcard, be sure always to take the test specifications from the vehicle-specific brief instructions.

SAFETY AND PRECAUTIONARY MEASURES

Be sure to observe safety and precautionary measures so as to avoid risk to persons and to prevent damage to the engine, trigger boxes, control units or the ignition system.

CAUTION!
High-energy ignition system with dangerous high and low voltages!

Touching live parts or terminals may be highly dangerous (both on the primary and secondary sides).

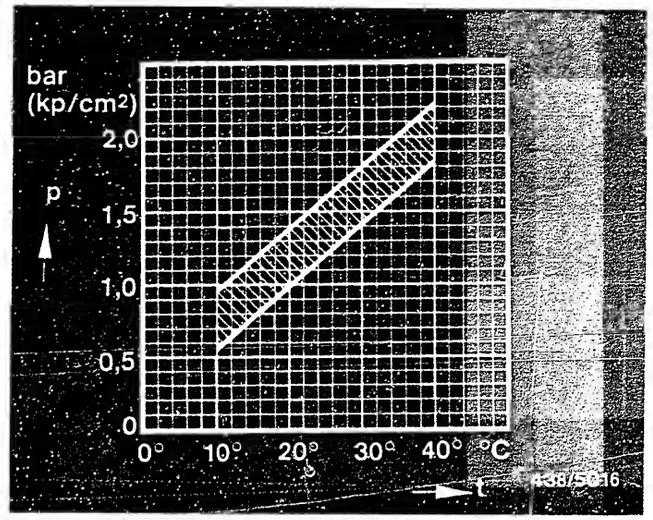
TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

1. Starting motor operates, but engine fails to start or starts only with difficulty.	2. Engine starts but then dies.	3. Rough idling (engine speed, exhaust gas).	4. Poor throttle take-up, flat spot during acceleration.	5. Misfiring (ignition, fuel injection).	6. Maximum engine power/top speed not reached.	7. Fuel consumption too high.	8. Engine running on (dieseling).	9. Engining pinging/knocking.	10. Engine becomes too hot.	11. Fault lamp.	Cause (component fault)
*	*			*							Electric fuel pump
*		*	*		*						Air-intake system
*											Fuel system
*		*	*		*		*				Fuel distributor
*		*	*	*	*		*				Air-flow sensor
*		*				*	*				Cold-start system
*		*		*			*				Injection valves
	*			*	*						Primary pressure
*	*	*	*	*	*	*					Control pressure
*		*	*		*						Fuel-delivery dispersion
					*						Throttle valve
*		*									Auxiliary air device
*		*	*			*	*				Basic idle setting

TEST SPECIFICATIONS

No.	Testing/Test condition	Set specification
1	Electric fuel pump – fuel delivery: Supply voltage (under load):	at least 1500 cm ^{3} /min at least 11,5 V
2	Fuel delivery – control-pressure circuit:	160...240 cm ^{3} /min
3	Fuel distributor – system pressure: Test specification: Setting:	 5,2...5,9 bar 5,4...5,6 bar
4	Control pressure: Take control pressure "cold" from the chart opposite corresponding to the ambient temperature measured. Control pressure "warm":	 3,4...3,8 bar
5	Leakage test – total system: Minimum pressure after 10 mins.: Minimum pressure after 20 mins.:	 3,4 bar 3,3 bar
6	Injection valves – opening pressure: Leakage test at not below 3,5 bar: No drop must fall within 25s.	3,7...4,8 bar

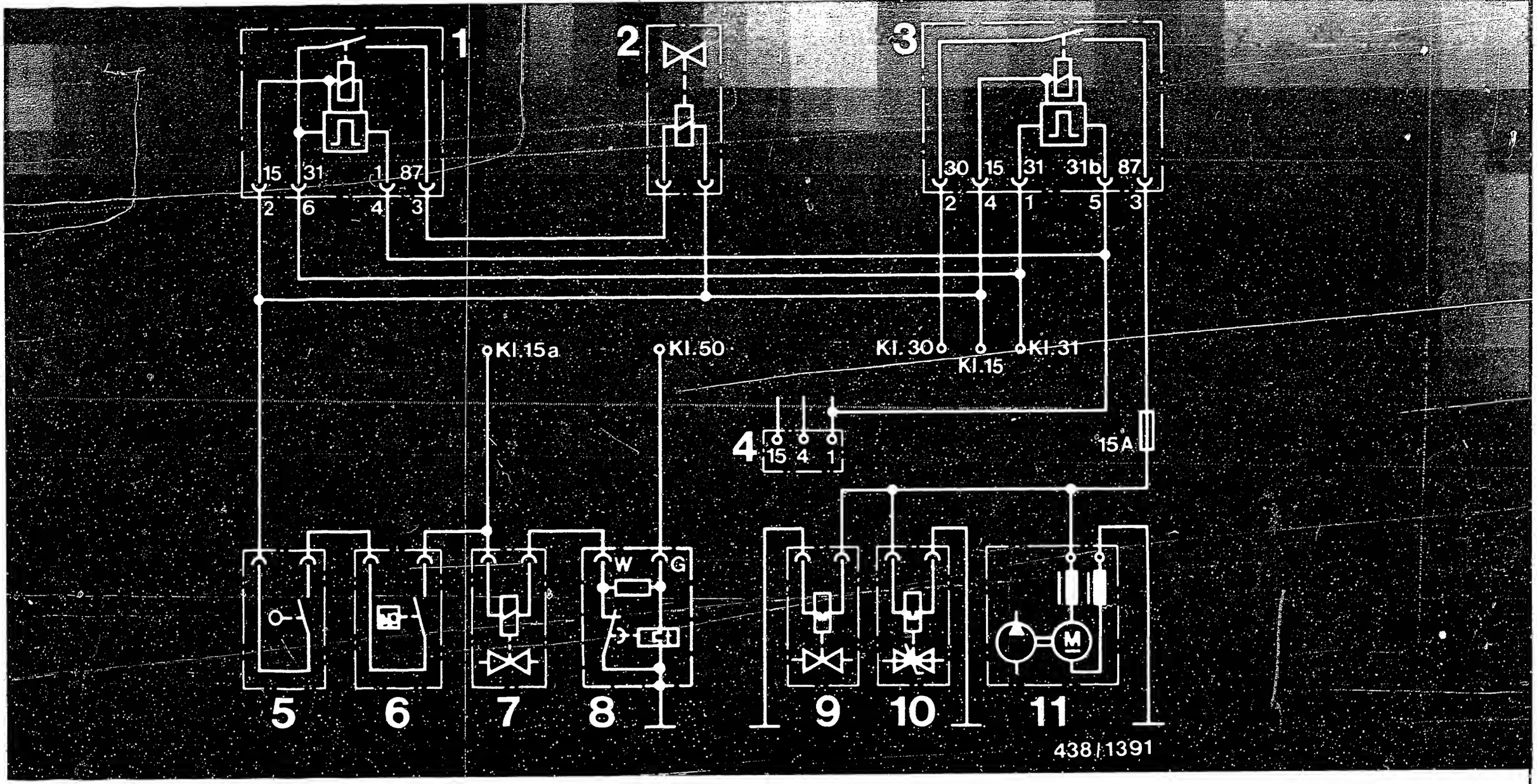


p = Contr. press. (overpress.)
t = Ambient temperature

TEST SPECIFICATIONS (CONTINUED)

No.	Testing/Test condition	Set value	
7	Fuel deliveries – comparative measurement:	Setting point: (cm^3/min)	Max. permis. flow: (cm^3/min)
	Idle:	6,0	6,6
	Part load:	40,0	43,0
	Full load:	110,0	120,0
	Minimum flow at max. deflection of air-flow sensor plate:	110 cm^3/min	
8	Thermo-time switch – resistance measurement:	Below + 30° C	Above + 40° C
	Terminal G and ground:	25...40 Ω	50...80 Ω
	Terminal W and ground:	0 Ω	100...160 Ω
	Terminal G and terminal W:	25...40 Ω	50...80 Ω
9	Idle adjustment*		
	Idle speed:	800...1000 min^{-1}	
	CO content:	0,5...1,5 % by vol.	

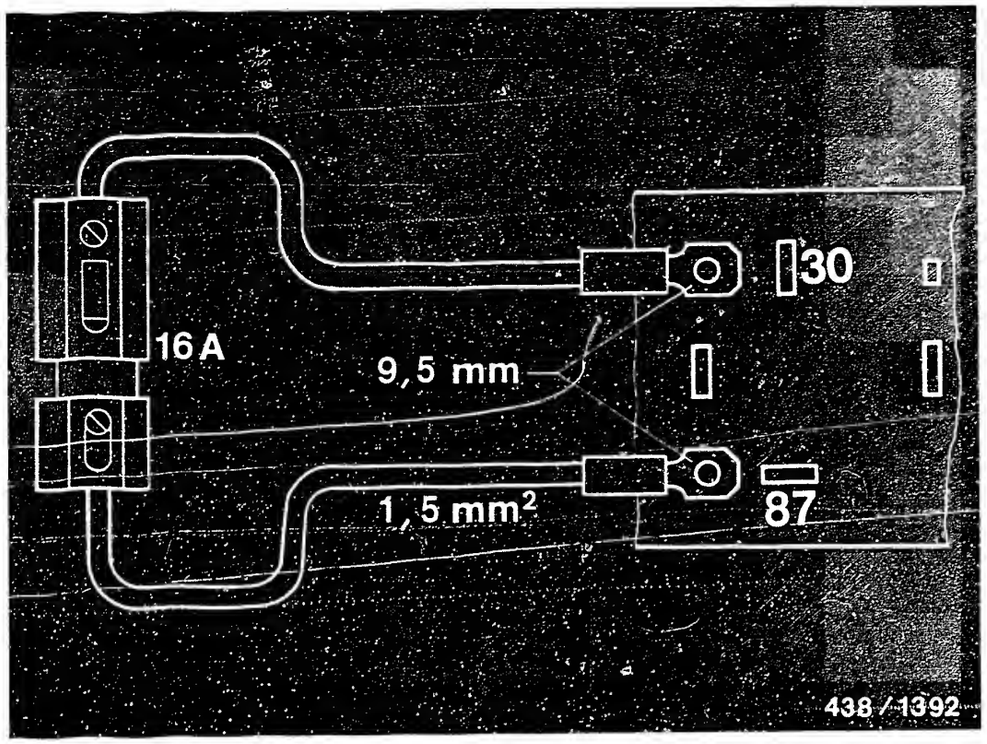
* Notes on idle adjustment:
Engine-oil temperature must be a minimum of 80 °C.
Hose for crankcase ventilation disconnected and routed so that only fresh air can be inducted.
Hose to idle-speed increase valve clamped.
All electrical loads switched on.
Fan of radiator must not be running.



1 = Control unit, idle-speed increase
2 = Idle-speed-increase valve
3 = Electronic relay
4 = Ignition coil
5 = Throttle-valve switch
6 = Pressure-operated snap-action switch
7 = Start valve
8 = Thermo-time switch
9 = Warm-up regulator
10 = Auxiliary-air device
11 = Electric fuel pump

ELECTRIC TERMINAL DIAGRAM WITH SAFETY CIRCUIT FOR ELECTRIC FUEL PUMP

L09 ⟹ | L10 ⟸



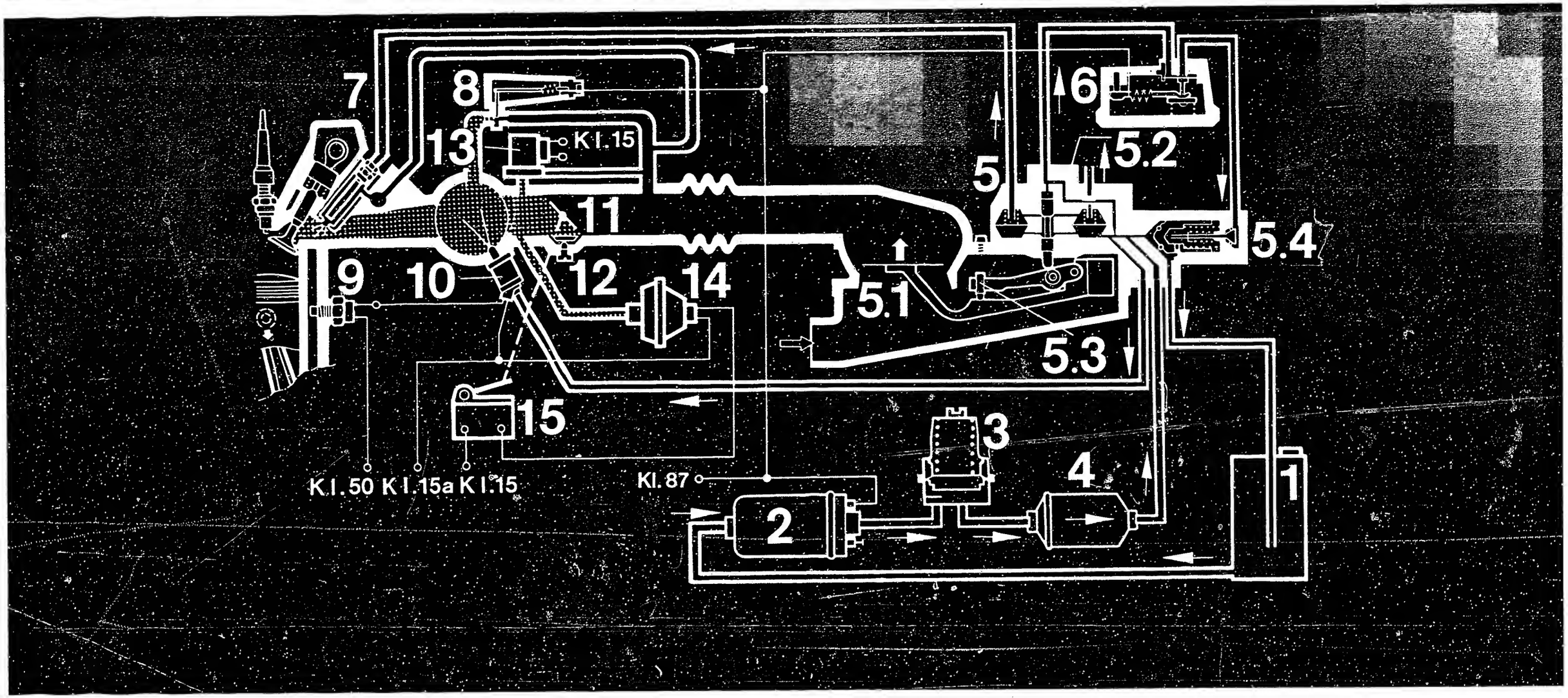
BRIDGING THE SAFETY CIRCUIT

Remove electronic relay from plug-in base. Connect contact 87 to contact 30 in the plug-in base with a bridge. Use a 1.5 mm ^{2} connecting cable with fuse link and 16 amp fuse.

In this way, battery voltage is supplied to the electric fuel pump, auxiliary-air device and warm-up regulator.

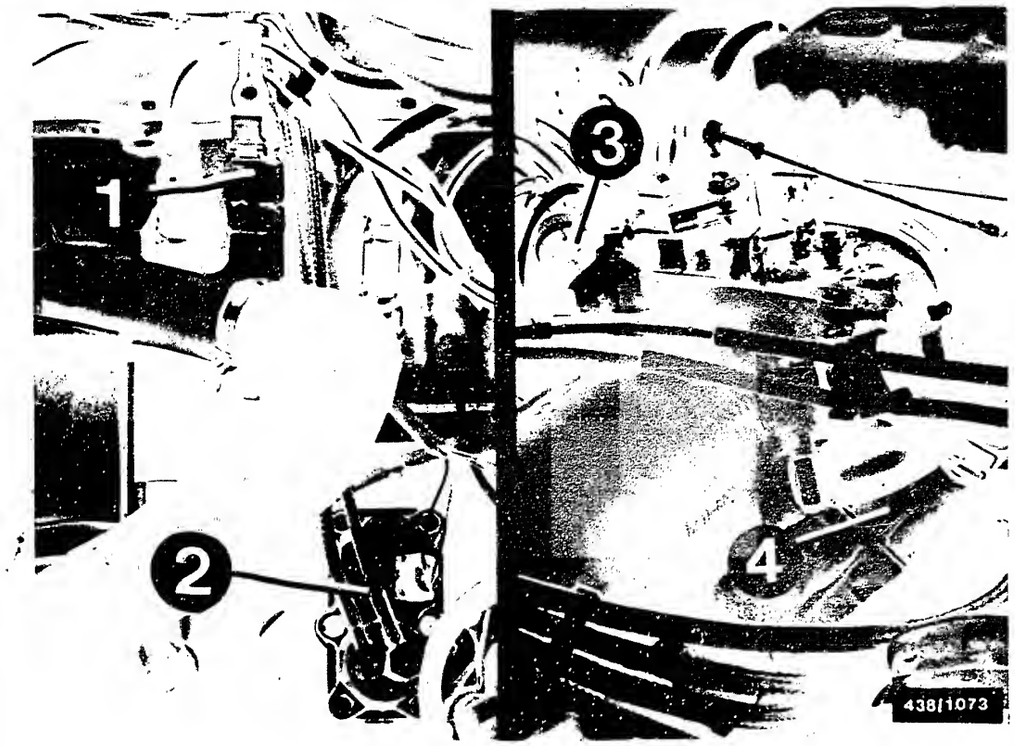
C a u t i o n :
Never deflect (raise) the sensor plate with the electric fuel pump running, since fuel is then injected via the injection valves.
Subsequent operation of the starting motor can lead to major damage to the engine.

For production reasons:
continued on the following coordinate.



1 = Fuel tank
2 = Electric fuel pump
3 = Fuel accumulator
4 = Fuel filter
5 = Mixture-control unit
5.1 = Air-flow sensor
5.2 = Fuel distributor
5.3 = Idle-mixture-adjusting screw
5.4 = Primary-pressure regulator
6 = Warm-up regulator
7 = Injection valve
8 = Auxiliary-air device
9 = Thermo-time switch
10 = Start valve
11 = Throttle valve
12 = Idle-speed bypass screw
13 = Idle-speed-increase valve
14 = Pressure-operated snap-action switch
15 = Throttle-valve switch

DIAGRAM OF AIR/FUEL LINES



1 = Thermo-time switch
2 = Warm-up regulator
3 = Start valve
4 = Auxiliary-air device

INSTALLATION POSITION OF COMPONENTS

* Electric fuel pump, fuel accumulator, fuel filter:
  on the floor of the vehicle over the rear axle.

* Electronic relay:
  in the central electrics console, to the left beneath the instrument panel.

* Idle-speed-increase valve:
  in the engine compartment on the firewall, next to the battery.

* Pressure-operated snap-action switch:
  in the engine compartment on the firewall, next to the ignition coil.

For production reasons:
continued on the following coordinate.

T A B L E O F C O N T E N T S

Trouble-shooting instructions	: AUD-5003
BOSCH system	: Ecotronic (4.0A)
Make of vehicle	: AUDI
Basic microcard	: MB-530

Section	Coordinate
Special features, safety, usage	02
Trouble-shooting chart	06
Self-diagnosis	08
Test specifications	19
Electrical terminal diagram	21
Installation position of components	23

SPECIAL FEATURES

* This microcard contains the ECO 4.0A trouble-shooting instructions, valid at the time of publication, for the following Audi-model:
  Audi 80 (04.87 ->)
  (with 1,6 l engine)
  Engine code letter: pp

* Ecotronic (ECO 4.0A) with 25 -pin control unit.

* The control unit is equipped with self-diagnosis. Should a fault occur in the system, this fault is stored in the fault memory and may be read out by the diagnostic lamp in the instrument panel.
  If a sensor fails, the control unit operates using specified substitute values.

* The ventilating valve in the throttle-valve actuator is supplied with filtered air via an additional filter (built on to the air filter).

* The system is similar to the Ecotronic (ECO 3), Mercedes-Benz
  See SIS MB-530.

SPECIAL FEATURES (continued):

The control range of the lambda closed-loop control system is indicated by means of the fault lamp installed.

Test and adjust the lambda closed-loop control range:

Correct adjustment of the lambda closed-loop control range is indicated by flashing pulses of the fault lamp.
Triggering the indicator:
- Switch off the ignition for at least 20 s.
- Bridge contacts A, B to relay of intake-manifold heater using fuse.
- Start engine and run at idle for at least 4 s.
- Remove fuse.
- Run engine until lambda sensor reaches normal operating temperature; to do this, increase engine speed for 1 mins to above 2000 up to max. 3500 min^{-1} .
  Note: if the engine speed is increased to above 4000 min^{-1} , the indication is cleared; retrigger the indicator.

Lambda closed-loop control in control range:
fault lamp flashes 1,5 times per second.

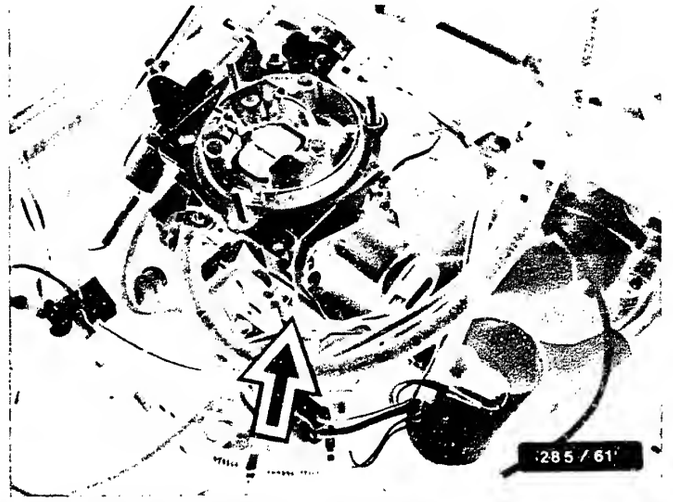
Lambda closed-loop control at rich stop:
fault lamp lights up constantly.

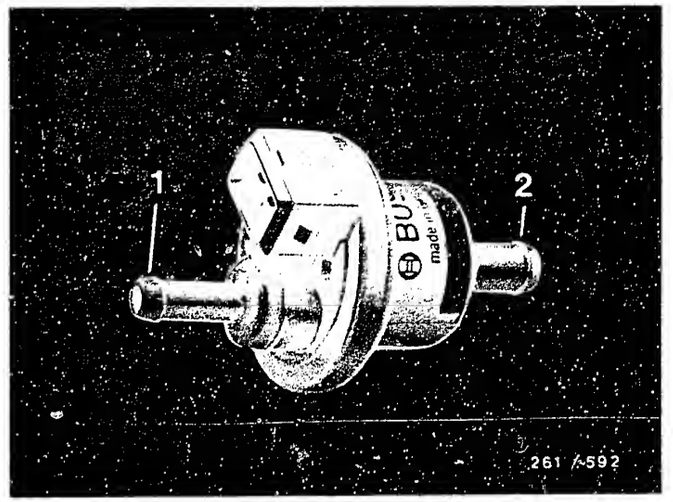
Lambda closed-loop control at lean stop:
fault lamp does not light.

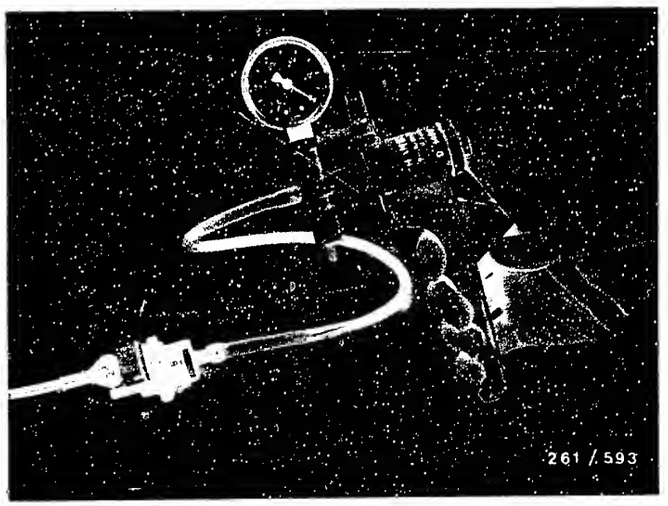
Adjust control range via idle-mixture-adjusting screw (upper illustration, arrow).
Note: fault lamp flickers (25 times per second)
- lambda sensor not at normal operating temperature
- break in lead to lambda sensor.

Check activated-carbon-filter valve for leaks:

Remove activated-carbon-filter valve.
Connect vacuum pump (e.g. Mityvac) to the connection of the valve on the intake-manifold side (center illustration, 2).
1. Valve deenergized -> opening (no vacuum build-up possible).
2. Trigger valve with battery voltage (10...15 V) (use connecting cable KDJE-7450/70) (lower illustration).
Generate vacuum of approx. 0,5 bar.
Permissible pressure drop: 0,25 bar in 10 s.







STRUCTURE, USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to various causes/component faults.
Detailed instructions for trouble-shooting must be taken from the basic instructions via the trouble-shooting chart.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of <u>these</u> vehicle-related brief instructions are <u>always</u> binding.

Finding individual test steps in the brief and basic instructions is possible via the tested function or components. Tests which deviate from the basic instructions are described under Special Features.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to prevent damage to the engine, control unit or ignition system, be sure to observe the safety and precautionary measures in the basic instructions.

* C A U T I O N !
  High-performance ignition system.
  Dangerous primary and secondary voltages.

  Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

See Basic Instructions for further precautionary measures.

TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)
1. Starting motor operates, but engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Rough idling (engine speed, exhaust gas).
4. Poor throttle response, flat spot during acceleration.
5. Misfiring (ignition, fuel induction).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine diesels.
9. Engine pings/knocks.
10. Engine becomes too hot.
11. Fault lamp.

1	2	3	4	5	6	7	8	9	10	11	Cause (component fault)
*	*	*	*	*	*	*	*	*	*	*	Evaluate self-diagnosis
										*	Fault lamp defective
								*	*		Poor fuel quality
*			*	*	*						Test fuel pressure
	*			*	*						Test fuel quantity
*	*	*	*	*	*	*					Choke-valve plate stiff
*	*			*	*						Test float-needle valve
*	*	*	*	*	*						Dirt in carburetor
	*	*	*	*	*						Induction system leaking
	*	*									Intake-manifold heating defective
	*	*									Intake-air pre-heating defective
					*						Exhaust system defective

TROUBLE-SHOOTING CHART (continued)

1. Starting motor operates, but engine fails to start or starts only with difficulty.	2. Engine starts but then dies.	3. Rough idling (Engine speed, exhaust gas).	4. Poor throttle response, flat spot during acceleration.	5. Misfiring (ignition, fuel induction).	6. Maximum engine power/top speed reached.	7. Fuel consumption too high.	8. Engine diesels.	9. Engine pings/knocks.	10. Engine becomes too hot.	11. Fault lamp.	Cause (component fault)
	*						*				Test adjustment, throttle valve stage I
	*	*	*	*	*						Incorrect type of nozzle
		*		*							Vacuum unit, stage II
	*	*		*							Test adjustment, throttle-valve stage II
		*		*	*						Test adjustment, accelerator actuation
	*	*									Throttle valve worn out
										*	Test TD signal
				*	*						Test enrichment tube
	*	*									Test bypass heating
*				*	*						Float-chamber change-over valve defective
	*	*									Test activated carbon filter (Visual exam.)
	*										Venting filter, throttle-valve actuator

TROUBLE-SHOOTING:
USING THE SELF-DIAGNOSIS:

A control unit is installed in this vehicle, which possesses a self-diagnosis facility. Therefore, always begin trouble-shooting with self-diagnosis.
Self-diagnosis is divided into two parts:

1. Reading out the fault memory (self-diagnosis)

2. Final-controlling-element diagnosis.

After stimulation of the self-diagnosis at the intake-manifold-heating relay, all the electronic control units intalled in the vehicle, which are equipped with self-diagnosis, are induced to output their diagnosis.
In the self-diagnosis test table starting on coordinates (13) , the indicated faults
of the Ecotronic are broken down.
The self-diagnosis test table contains fault indication, components tested, test clips at control-unit plugs, cause of trouble, test instructions and set values.

Only if there is no fault stored in the fault memory, but there is a customer complaint, must trouble-shooting be performed in accordance with the trouble-shooting charts starting at coordinate (06) .
Only the components which cannot be tested via the self-diagnosis facility are listed in the trouble-shooting charts.

SELF-DIAGNOSIS

Fault lamp (engine indicator lamp)
Fault lamp in instrument panel lights up when the ignition is switched on.
Start engine: 1. Fault lamp goes out shortly after the engine starts to run.
2. Fault lamp does not go out or fault lamp lights up constantly or intermittently during driving: No engine-speed signal present, or contacts at intake-manifold-heating relay bridged.

Activating the self-diagnosis:

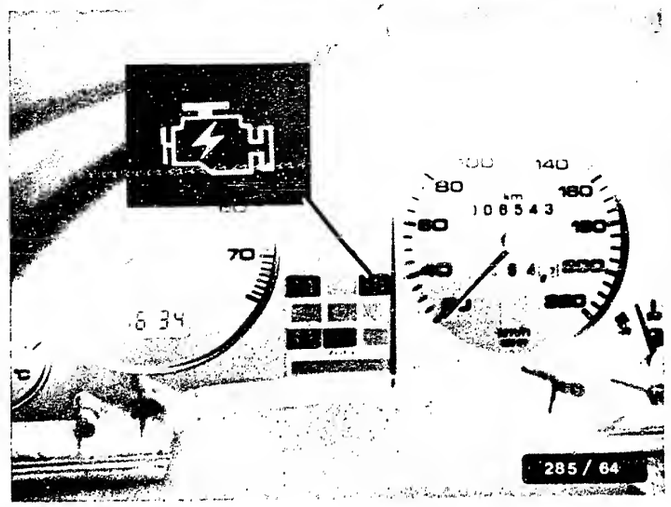
Leave the engine running at idle (if necessary, take for test drive beforehand) or operate starting motor for approx. 6 seconds (do not switch off ignition).
With a fuse (smaller than 25 A) at the intake-manifold-heating relay (center illustration), apply excitation lead to control unit (term. 6) for longer than 4 seconds to ground.
Output of the self-diagnosis begins with a start signal (lower illustration, a) (fault lamp lights up approx. 2,5 s.)

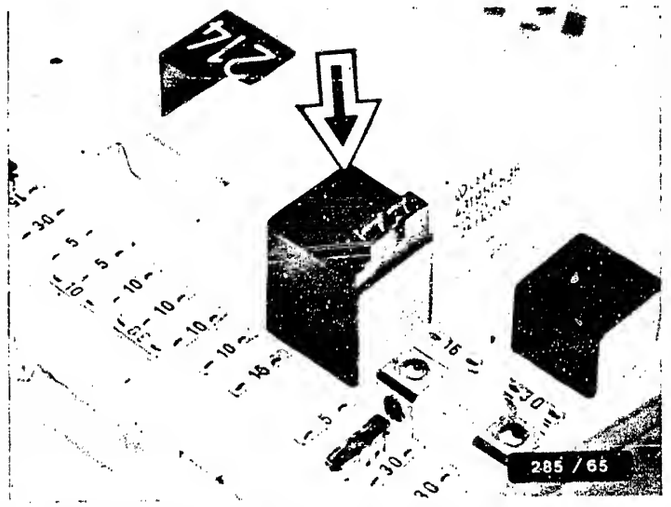
Activating the final-controlling-element diagnosis:

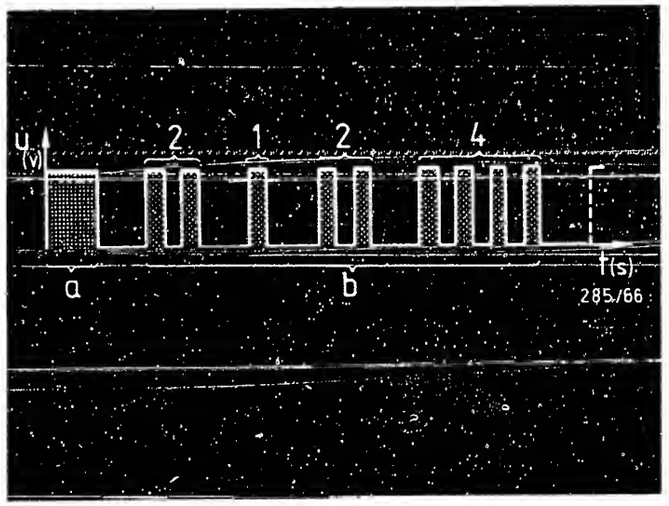
Switch off the ignition (min. 20 s.). Using a fuse, apply exitation lead at intake-manifold-heating relay to ground.
Switch on ignition.
After longer than 4 seconds, disconnect the fuse.
On output of the final-controlling element diagnosis (flashing code 4323, 4324, 4342 and 4343), the corresponding final controlling elements are triggered simultaneously with output of the flashing code and can be tested by listening/feeling (flashing code indicates only which component is triggered).

Continuing diagnosis:

After one fault has been read out, the next fault is output/ the next final controlling element triggered through renewed short circuit to ground for longer than 4 seconds.







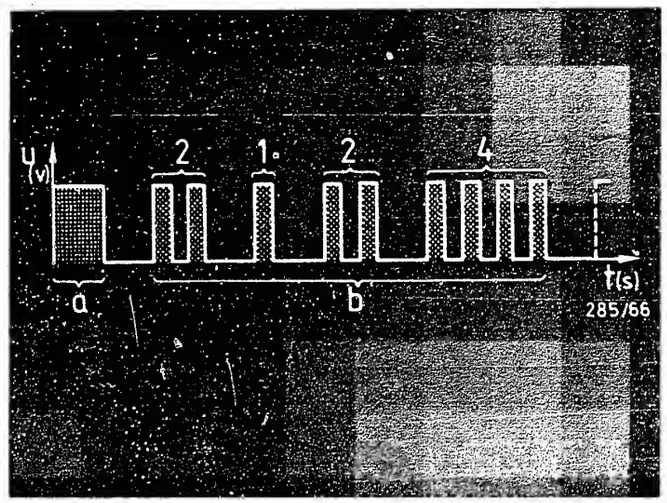
Evaluating the flashing code (lower illustration, b):

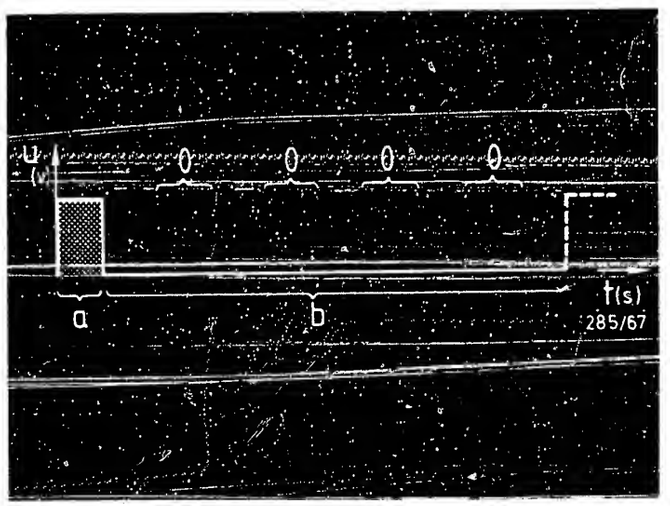
The flashing code for each fault consists of four flashing-pulse blocks. Each block represents a number and comprises 1 up to 4 pulses. One pulse corresponds to the number 1 , four pulses correspond to the number 4 . The fault lamp lights up briefly with every pulse.

There is a longer pause between the blocks than there is between the individual pulses. After a fault code has been output, the new fault code is initiated by a renewed short circuit to ground of longer than 4 s.. If no fault is stored in the control unit, the flashing code 4444 is output.

If a fault is stored in the control unit, the first fault (upper illustration, b) is output after the start signal. If a further fault is stored, its flashing code is output by a renewed short circuit ground.

The sequence must be continued until the flashing code 0000 (see lower illustration) indicates the end of self-diagnosis.
The fault memory is cleared by switching off the ignition and approx. 15 seconds later, the main relay drops out.





SELF–DIAGNOSIS TEST TABLE

Fault indic. Flash code	Testing of component/function	Test instructions/Test conditions	Termin–als		Set values
4444	Control unit	Control unit indicates that there is no fault stored in the fault memory.	—		—
1111	Control unit defective		—		—
2224	Maximum engine speed exceeded	Maximum engine speed 7000 min $^{-1}$ was exceeded when driving. (Test engine–speed limitation on vehicle–performance tester).	25 12	2 12	6950 min $^{-1}$ –0,6...–2,8 A
2124	Potentiometer in throttle–valve actuator (short circuit to ground/open circuit)	Resistance throttle–valve potentiometer and throttle–valve actuator parallel: Wiper resistance, potentiometer in throttle–valve actuator: (while testing, actuate evacuating valve in throttle–valve actuator and pull back throttle–valve actuator using hand vacuum pump). Resistance value drops continuously.	18 17 17	13 13 13	0,7...1,3 k Ω max: 1,4...2,4 k Ω min: less than 400 Ω
2212	Throttle–valve potentio–meter (short circuit to ground/open circuit)	Resistance throttle–valve potentiometer and throttle–valve actuator parallel: Wiper resistance, throttle–valve potentiometer: Run engine at idle. Seal off ventilating side of throttle–valve actuator. Switch off engine. Switch on ignition. Slowly push accelerator pedal from idle position to full–load position: Resistance value is altered continuously between min. and max..	18 11 11	13 13 13	0,7...1,3 k Ω max: 1,4...2,4 k Ω min: less than 270 Ω

SELF–DIAGNOSIS TEST TABLE (continued)

Fault indic. Flash code	Testing of components/function	Test instructions/Test conditions	Termin–als	Set values
2312	Coolant–temperature sensor (short circuit to ground/open circuit)	Resistance of temperature sensor: at 20°C at 80°C	21 13 21 13	2,0...3,0 k Ω 280...360 Ω
2341	Lambda closed–loop control at control limit	Test lambda closed–loop control and re–adjust control range: initiate indication of lambda control range at intake–manifold–heating relay.	6	Fault lamp in instrument panel flashes with 1,5 Hz
2342	Lambda sensor	Test lead from control unit term. 8 to plug connection of lambda sensor for short circuit and open circuit (plug connection of lambda sensor disconnected).	8 2 8	greater than 1 M Ω approx. 0 Ω
2412	Intake–manifold tempera–ture sensor (short circuit to ground/open circuit)	Resistance of temperature sensor: at 20°C at 80°C	5 13 5 13	2,0...3,0 k Ω 280...360 Ω
0000	Diagnosis output complete	Control unit indicates that the diagnosis output is complete. Fault lamp flashes at 2,5 s. intervals (start signal).	—	———

SELF-DIAGNOSIS TEST TABLE (continued)
Final-controlling-element diagnosis (component is activated by control unit during flashing-code output).

Flash code	Testing of components/function	Test instructions/Test conditions	Terminals	Set values
4432	Chcke-valve actuator	Choke-valve actuator is activated during diagnosis output. Insulation resistance of choke-valve actuator: Winding resistance of choke-valve actuator:	 10 12 10 12	 greater than 1M Ω less than 10 Ω
4343	Activated-carbon-filter bleeder valve	Final-controlling-element diagnosis: bleeder valve is actuated during flashing-code output. Insulation resistance Winding resistance	 15 2 15 23	 greater than 1 M Ω less than 50 Ω
4342	Relay for intake pre-heating	Final-controlling-element diagnosis: relay is actuated during flashing-code output. Insulation resistance Winding resistance	 14 2 14 23	 greater than 1 M Ω less than 50 Ω
4323	Ventilating valve in throttle-valve actuator	Final-controlling-element diagnosis: ventilating valve is actuated during flashing-code output. Insulation resistance, ventilating valve: Winding resistance, ventilating valve:	 9 2 9 23	 greater than 1M Ω 20...80 Ω
4324	Evacuating valve in throttle-valve actuator	Final-controlling-element diagnosis: evacuating valve is actuated during flashing-code output. Insulation resistance, evacuating valve: Winding resistance, evacuating valve:	 3 2 3 23	 greater than 1M Ω 20...80 Ω
0000	Diagnosis output complete	Control unit indicates that the diagnosis output is complete. Fault lamp flashes at 2,5 s. interval (start signal).	—	———

TEST SPECIFICATIONS:

Idle speed: 900 ± 75 min $^{-1}$
Note: the idle speed is controlled and cannot be adjusted.

Engine-speed limitation 7000 ± 50 min $^{-1}$

Exhaust-gas adjustment:
Test CO value at sampling pipe before catalytic converter: %CO by vol. 0,2...1,0
To do this, hose for engine ventilation and lead to lambda sensor are disconnected.

Fuel pressure: 0,1...0,3 bar
Minimum fuel delivery (at 2000 min $^{-1}$) 1 l/min

Float weight: 7,7 ± 0,3 g
Float height: 27,5 ± 1,0 mm
(Float level cannot be adjusted)

Throttle-valve potentiometer
Total resistance: 1.4...2.6 k Ω
Wiper resistance in correcting range: min. less than 270 Ω
max. 1,4...2,4 k Ω

Choke-valve actuator.
Winding resistance: 0,9...1,7 Ω

Basic setting, throttle valve
Stage I (with feeler gauge) 3,15 mm
Stage II a = 0,03 ± 0,02 mm

Release and forced return
Stage II: Y = 1,0 ± 0,3 mm
Z = 0,4 ± 0,2 mm

Float-chamber change-over valve
Winding resistance less than 50 Ω

Activated-carbon-filter bleeder valve
Winding resistance: 30...60 Ω

TEST SPECIFICATIONS (continued):

Throttle-valve actuator
Evacuating valve (term. 1 /term. 2): 20...70 Ω
Ventilating valve (term. 6/term. 7): 20...70 Ω
Total resistance, potentiometer (term. 3/term. 4): 1,4...2,6 k Ω
Wiper resistance in correcting range (term. 5/term.3): min. less than 400 Ω
max. 1,4...2,4 k Ω

Temperature sensor (NTC):
Internal resistance at 20°C: 2,0...3,0 k Ω
at 80°C: 280...360 Ω

Heating element, intake-manifold heating:
Internal resistance at 20°C: approx. 0,25...0,5 Ω

Heating element, part-load channel:
Internal resistance at 20°C: approx. 1,5...2,5 Ω

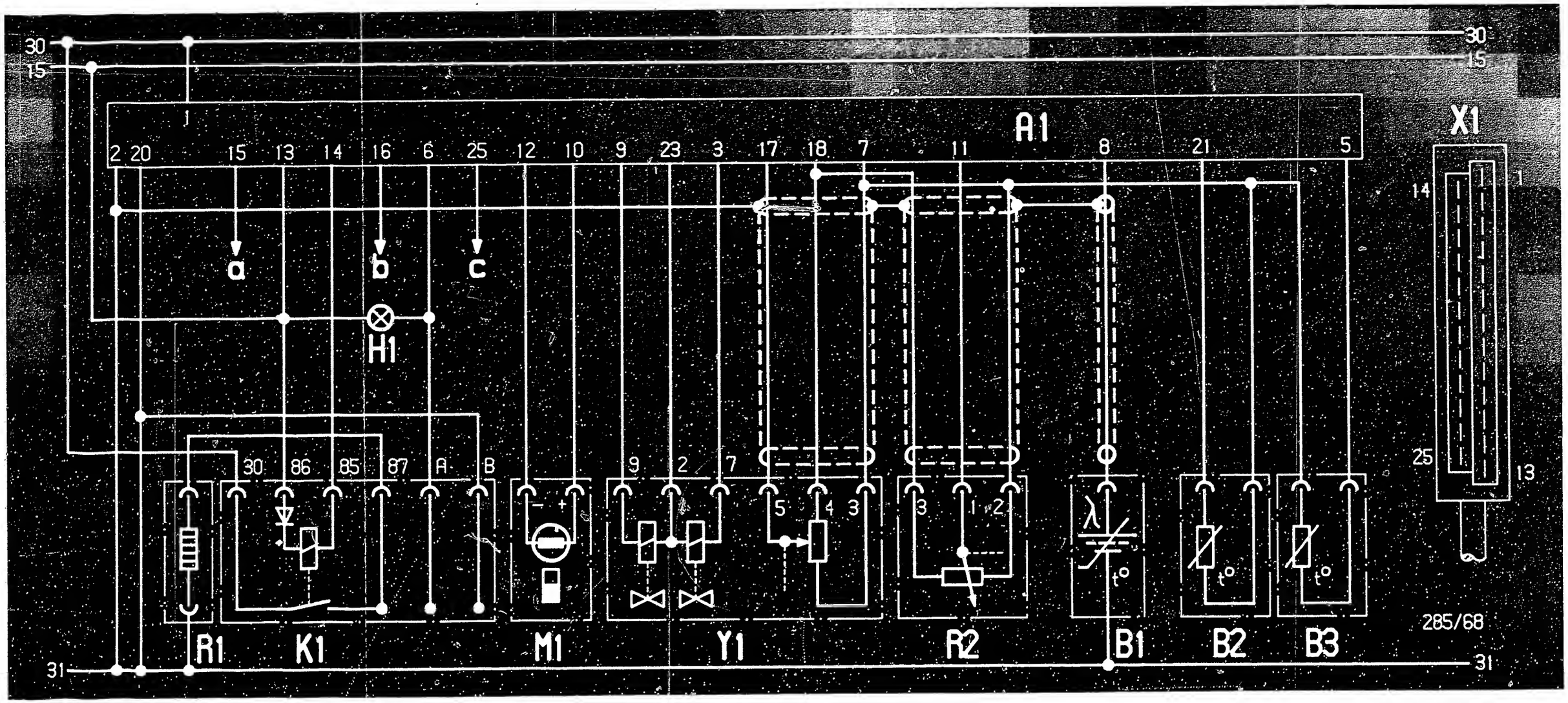
Type of nozzle:

	Stage 1	Stage 2
Main nozzle	x 105	x 110
Idle fuel nozzle	x 45	
Acceleration fuel nozzle		90
Air correction nozzle (with mixing tube)	x 110	x 105
Acceleration air nozzle		x 130
Full-load enrichment		100 ± 10

Tube for full-load enrichment
Height above pre-atomizer 13,5 ± 1,0 mm

Tightening torques
Securing of carburetor upper section 5 Nm
Flange mounting 13 Nm

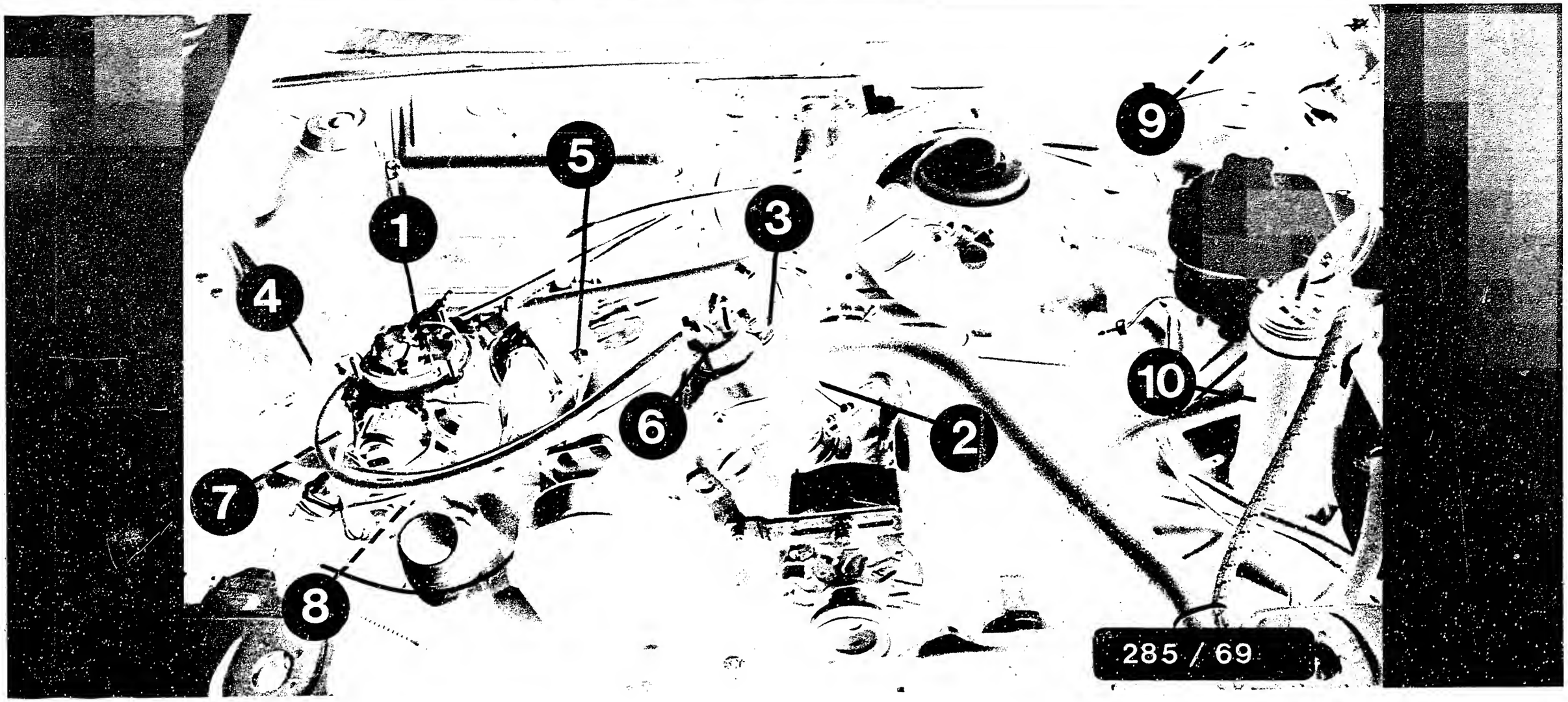
See equipment and Autodata microcards for setting values for valve clearance and other motor-related data.



ELECTRICAL TERMINAL DIAGRAM OF ECOTRONIC

A1 = Control unit, Ecotronic
X1 = Plug assignment
R1 = Heat. elem., intake-manif. heating
K1 = Relay, intake-manifold heating (contacts A,B for stimulation of self-diagnosis)
M1 = Choke-valve actuator
Y1 = Throttle-valve actuator
R2 = Potentiometer, main throttle valve
B1 = Lambda sensor
B2 = Temperature sensor, coolant
B3 = Temperature sensor, intake manifold
H1 = Diagnostic lamp
a = to bleeder valve, activated carb. filt.
b = Transmission recog.
c = TD signal

M21 ⟹
M22 ⟸

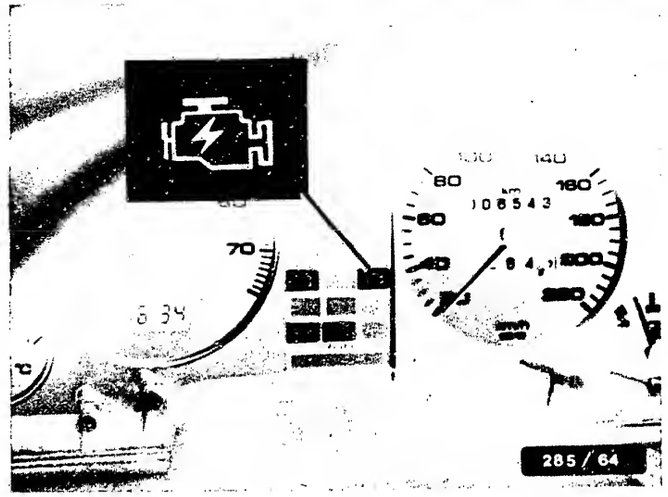


INSTALLATION POSITION OF COMPONENTS

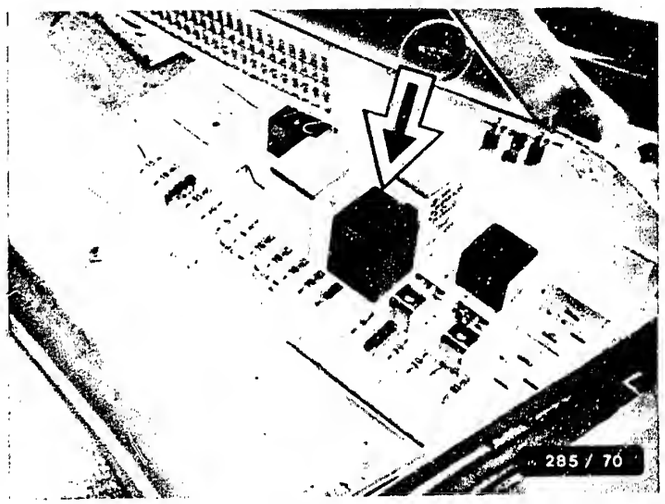
1 = Carburetor
2 = Ignition distributor
3 = Temperature sensor, coolant
4 = Activated carbon filter, control valve
5 = Temperature sensor, intake manifold
6 = Vapor-bubble separator
7 = Sampling pipe for CO measurement
8 = Lambda sensor
9 = Central electrics
10 = Activated carbon filter

INSTALLATION POSITION OF COMPONENTS (continued)

The fault lamp is located in the instrument panel (upper illustration).



The relay of the intake-manifold heating is located in the central electrics (center illustration, arrow).



The control unit is installed in the right-hand footwell beneath the cover (already removed in the lower illustration).